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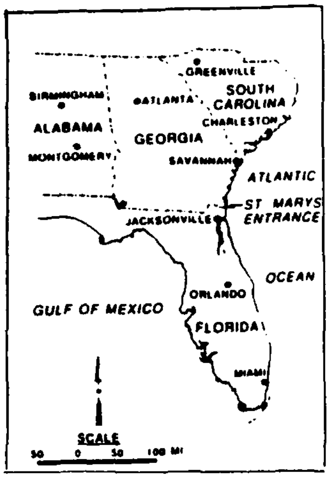

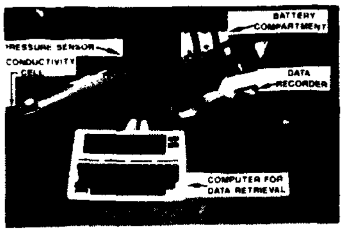

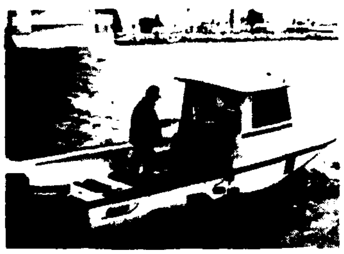

HYDRAULICS LABORATORY

TECHNICAL REPORT HL-92-4

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HYDRODYNAMIC DATA COLLECTION IN CUMBERLAND SOUND, GEORGIA

by

Timothy L. Fagerburg, Stephen C. Knowles
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13. ABSTRACT *(Maximum 200 words)*
A 5-year estuarine monitoring program was established in Cumberland Sound to obtain seasonal, long-term, continuous monitoring of water levels and conductivity and temperature measurements. Midway through the program, an intensive hydrodynamic data collection effort was scheduled to obtain post channel modification data of current speeds and directions, salinity and suspended sediment concentrations, water levels, and wind speed and direction. These data are to be compared with data obtained prior to the channel modifications. All of the field data collected in Cumberland Sound during May 1990 are presented. The report also describes the field investigation methods used to collect the data, summarizes laboratory methods used to analyze samples, shows results of the data reduction efforts, and presents compiled data sets.

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PREFACE

The work described in this report was performed by the Hydraulics Laboratory (HL) of the US Army Engineer Waterways Experiment Station (WES) during May 1990 as a part of the overall Cumberland Sound Monitoring Program conducted for the Department of the Navy (DON) under coordination of US Army Engineer Division, South Atlantic (SAD).

This study was conducted under the direction of Messrs. Frank A. Herrmann, Jr., Director, HL; Richard A. Sager, Assistant Director, HL; William H. McAnally, Jr., Chief, Estuaries Division (ED), HL, and George M. Fisackerly, Chief, Estuarine Processes Branch (EPB), HL. Ms. Joan Pope, Chief, Coastal Structures and Evaluation Branch, Coastal Engineering Research Center (CERC), served as the point of contact (POC) for all WES activities during the study. Mr. James Robinson (SAD) was the POC for the Department of the Army, and Mr. Darryl Molzan, Naval Facilities Engineering Command (NAVFAC), Southern Division (SOUTHDIV), was POC for the DON.

The HL portion of the project study was managed by Mr. Fisackerly. The field data collection program was designed by Messrs. Fisackerly, Timothy L. Fagerburg, Howard A. Benson, and Joseph W. Parman, all of EPB, and executed under the direction of Messrs. Fagerburg and Benson. Other ED personnel participating in the data collection were Messrs. Samuel E. Varnell and Stephen C. Knowles (EPB), Julian M. Savage, formerly EPB, John S. Ashley and Robert A. Evans, Estuarine Simulation Branch (ESB), and Michael P. Alexander, Estuarine Engineering Branch (EEG). Data reduction was performed by Mrs. Clara J. Coleman (EPB) and Messrs. Fagerburg and Knowles. Laboratory analyses of water samples were performed by Messrs. Larry G. Caviness (EPB) and Knowles. This report was prepared by Messrs. Fisackerly, Fagerburg, Knowles, Benson, and Parman.

At the time of publication of this report, the Director of WES was Dr. Robert W. Whalin. Commander and Deputy Director was COL Leonard G. Hassell, EN.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurements used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
cubic feet per second	0.02831685	cubic metres per second
feet	0.3048	metres
feet per second	0.3048	metres per second
inches	2.54	centimetres
miles (US nautical)	1.852	kilometres
miles (US statute)	1.609347	kilometres
ounces (US fluid)	0.02957353	cubic millimetres

HYDRODYNAMIC DATA COLLECTION IN CUMBERLAND SOUND, GEORGIA

PART I: INTRODUCTION

Background

1. The Cumberland Sound estuarine system in southeast Georgia includes extensive salt marshes and sand flats (shaded areas in Figure 1) typical of the sea island system of southeast Georgia. A Naval Submarine Base, Kings Bay, is located within the sound and is about 9.6 nautical miles (n.m.)* north of the St. Marys Inlet entrance jetties at the Atlantic Ocean. The mean tidal range at the ocean entrance between Amelia Island, in the state of Florida, and Cumberland Island, in the state of Georgia, is 5.8 ft. Maximum spring tidal ranges can exceed 8.0 ft in the interior portions of the estuary.

2. The primary sources of fresh water for the Cumberland Sound estuarine system are the St. Marys and the Crooked Rivers. The long-term average freshwater discharge at the mouth of the rivers is about 1,500 cfs from the St. Marys River and 100 cfs from the Crooked River. Suspended sediment loads within the rivers are generally low.

3. Cumberland Sound is considered to be a well-mixed estuarine system due to the relatively low average total freshwater discharge and the relatively high tidal range and associated strong current velocities. Salinity within the sound and Kings Bay is generally vertically and laterally homogeneous. Longitudinally, salinity within the sound is only slightly reduced from the ocean entrance conditions. Salinity in Kings Bay typically varies from about 26 to 32 ppt during the year.

4. The original Kings Bay facility, located adjacent to Cumberland Sound in southeast Georgia, was originally developed as an emergency Army Munitions Operation Transportation facility in the late 1950's. Initial channel depths were authorized at 32 ft mean low water.** The facility was

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* A table of factors for converting non-SI units of measurement to SI (metric) units is found on page 3.

** All depths and elevations described in this report refer to local mean low water (mlw), which is 2.75 ft below National Geodetic Vertical Datum (NGVD).

never used for the original purpose. Figure 1 shows the general Cumberland Sound and Kings Bay area.

5. The Department of the Navy acquired the Kings Bay facility in July 1978 for use as a submarine base for Poseidon-class submarines. Between July 1978 and July 1979, major channel realignment, widening, and deepening were performed for Poseidon facility expansion on the lower entrance channels and the interior approach channels. The length of the interior channel from the throat of St. Marys entrance adjacent to Fort Clinch to the end of the Kings Bay main docking facility was about 7 n.m.

6. With the advent of the Trident submarines, recent changes to the channel were made to accommodate these large submarines. The Trident facilities expansion included widening and deepening the approach channel, deepening the ocean entrance, deepening and widening portions of Kings Bay, as well as construction of various facilities in and around the submarine base. The specifics of these changes have been described in an earlier report*.

7. In response to these recent changes, a 5-year study (1988-1992) was established to assess the effects of the Trident project on the estuarine and coastal processes in the area of Cumberland and Amelia Islands and Cumberland Sound. The US Army Engineer Waterways Experiment Station (WES) Hydraulics Laboratory (HL) was responsible for the program's estuarine studies. These studies included some numerical model testing and long- and short-term field data collection to assess the effects on the hydrodynamics of the system. The areas of interest included tidal effects, changes in salinity, and sedimentation.

Purpose

8. The 5-year Cumberland Sound estuarine monitoring program was established to obtain seasonal, long-term, continuous monitoring of water level and conductivity and temperature measurements. At the midpoint of this period, one intensive hydrodynamic data collection effort was scheduled to obtain

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* Granat, Mitchell A., Brogdon, Noble J., Cartwright, John T., and McAnally, William H. 1989. Verification of the Hydrodynamic and Sediment Transport Hybrid Modeling System for Cumberland Sound and Kings Bay Navigation Channel, Georgia," Technical Report HL-89-14, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

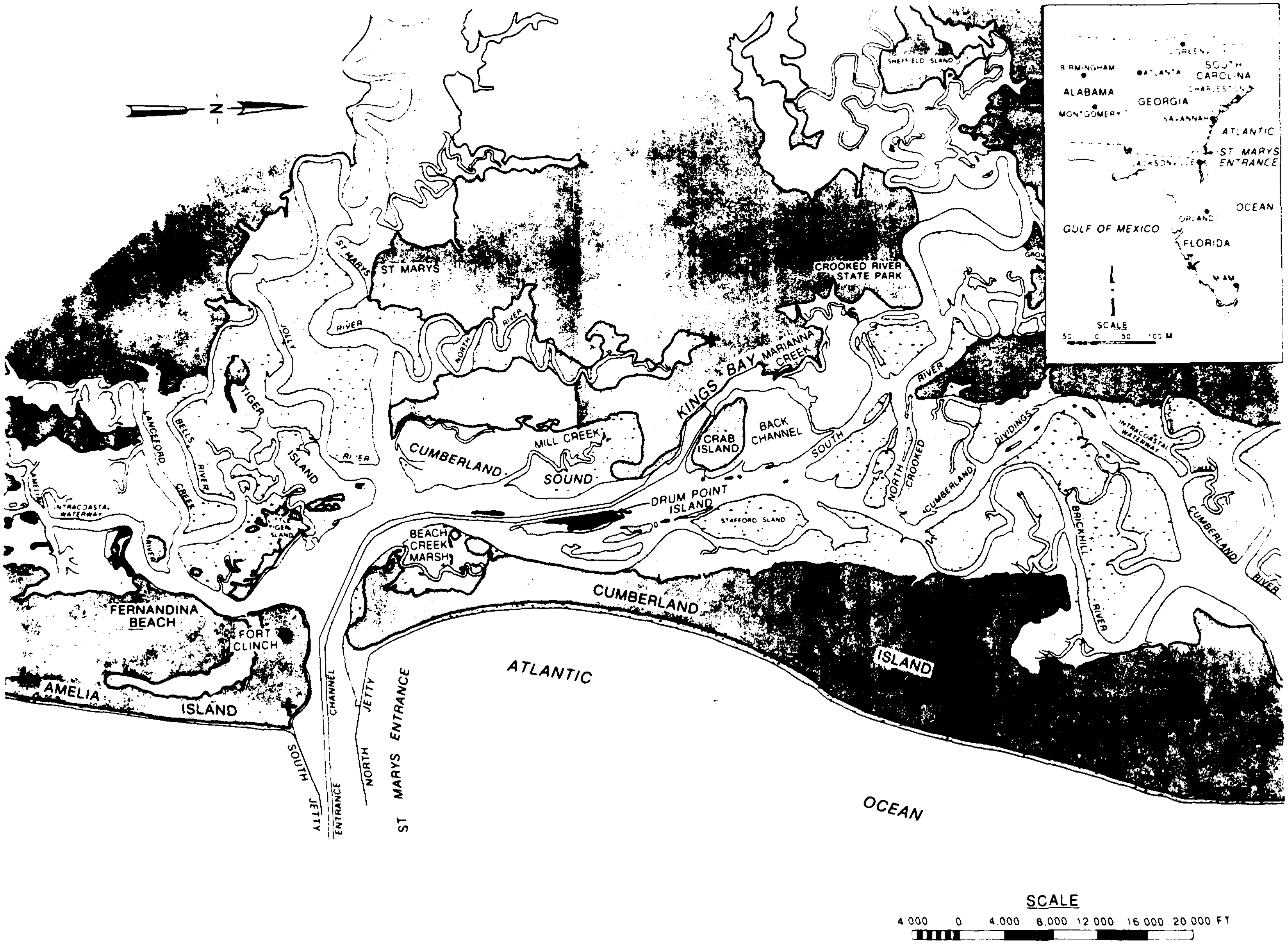


Figure 1. Cumberland Sound and Kings Bay vicinity map

postchannel modification data of current speeds and directions, salinity and suspended sediment concentrations, water levels, and wind speed and direction. These data are to be used for comparison with data acquired prior to the channel modification (1982 and 1985), and the analysis is to be presented in a final report at the end of the study. The purpose of this report is to provide a permanent record of the data collected during the intensive hydrodynamic survey conducted on 7 and 8 May 1990.

Scope

9. This report presents all of the field data collected in the Cumberland Sound system during May 1990. Measurements and samples consisted of the following:

- a. Water level elevations at six stations.
- b. Conductivity/salinity measurements at each station.
- c. Temperature measurements at each station.
- d. Current speed and direction at seven ranges.
- e. Suspended sediment and salinity samples at each range.
- f. Sediment settling velocity samples at four ranges.
- g. Automated water samples at six locations.
- h. Wind speed and direction in the study area.
- i. Bottom sediment samples at seven ranges.

10. This report also describes the field investigation methods used to collect the data, summarizes laboratory methods used to analyze samples, shows results of the data reduction efforts, and presents compiled data sets. Although some comments on general trends illustrated by the data are included, detailed analysis is not within the scope of this report.

PART II: DATA COLLECTION PROGRAM

11. Data were collected in Cumberland Sound from 5 to 9 May 1990. During this time, water level recorders and water samplers were in place and sampling continuously. Two major data collection schedules (13-hr surveys) were structured around the deployment of longer term in-situ recording current meters. The following data sets were collected with boat-mounted equipment during the 13-hr surveys: current speed and direction, suspended sediment, salinity, bottom sediment, and wind velocity.

Field Equipment

Water level recorders

12. Water level elevations were recorded using Environmental Devices Corporation (ENDECO) model 1152 SSM (solid state measurement) water level recorders similar to the recorder shown in Figure 2. The ENDECO model 1152 SSM recorder contains a strain-gage-type pressure transducer located in a subsurface case which is used to record the absolute pressure of the column of water above the case. The pressure transducer is vented to the atmosphere by a small tube in the signal cable to compensate for any changes in atmospheric pressure. Pressures were measured for 49 sec of each minute of the recording interval with a frequency of 5-55 kHz to filter out surface waves, thereby

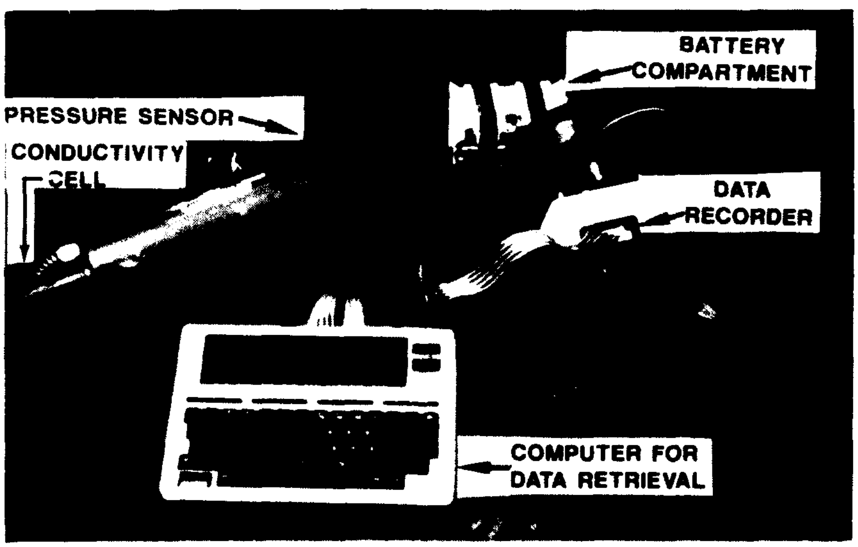


Figure 2. Water level recorder

eliminating the need for a stilling well. The accuracy is ±0.1 percent of full scale. The sampling time interval can be set from 1 min to 1 hr on the 1152 SSM. A 10-min sampling interval was chosen for this study. Deployment of the water level recorders during the survey is shown in Figure 3.

Temperature, conductivity,
and salinity measuring equipment

13. The ENDECO 1152 also measures temperature by means of a thermilinear thermistor built into the water level recorder. The thermistor has a range of -5 C to +45 C, with an accuracy of ±0.2 percent of full scale. Conductivity is measured by means of an inductively coupled probe installed on the meter. The probe has a range of 0-80 mmho/cm with an accuracy of ±0.55 mmho/cm. Salinity values are then computed from the output of the conductivity and temperature measurements and displayed in units of parts per thousand (ppt).

14. The sampling time interval for temperature and conductivity was 10 min, the same as that for the water level measurements. Data from each recorder are stored on a removable EPROM solid state memory cartridge located in a waterproof surface unit which also contains the DC power supply.

Automatic water sampler

15. Water samples for suspended sediment concentrations were taken during the survey period and during the periods before and after the survey using American Sigma Model 702 automatic water samplers, as shown in Figure 4. A typical field installation of these water samplers is shown in Figure 5. The samplers operate from a 12-volt d-c battery power source. Samples are collected in 1-ℓ plastic bottles located inside the sampler. The samplers are fully programmable for obtaining any volume of water desired up to the maximum size of the bottle. This programmable feature allows several sampling schemes including composite sampling, variable time intervals between samples and different times to begin sampling. When the sampling periods were complete, sample bottles were replaced with empty bottles to begin new sampling periods. Samplers were programmed to start at 0700 on 7 May, collecting three subsamples per bottle with 60 min between each subsample. Samplers collected at least 17 samples, representing at least 51 hr of data.

16. Locations of the six samplers were selected to provide coverage of the area (Figure 3). Samplers were deployed as follows: on the entrance marker near the southern end of the sound; at channel marker 13 in the

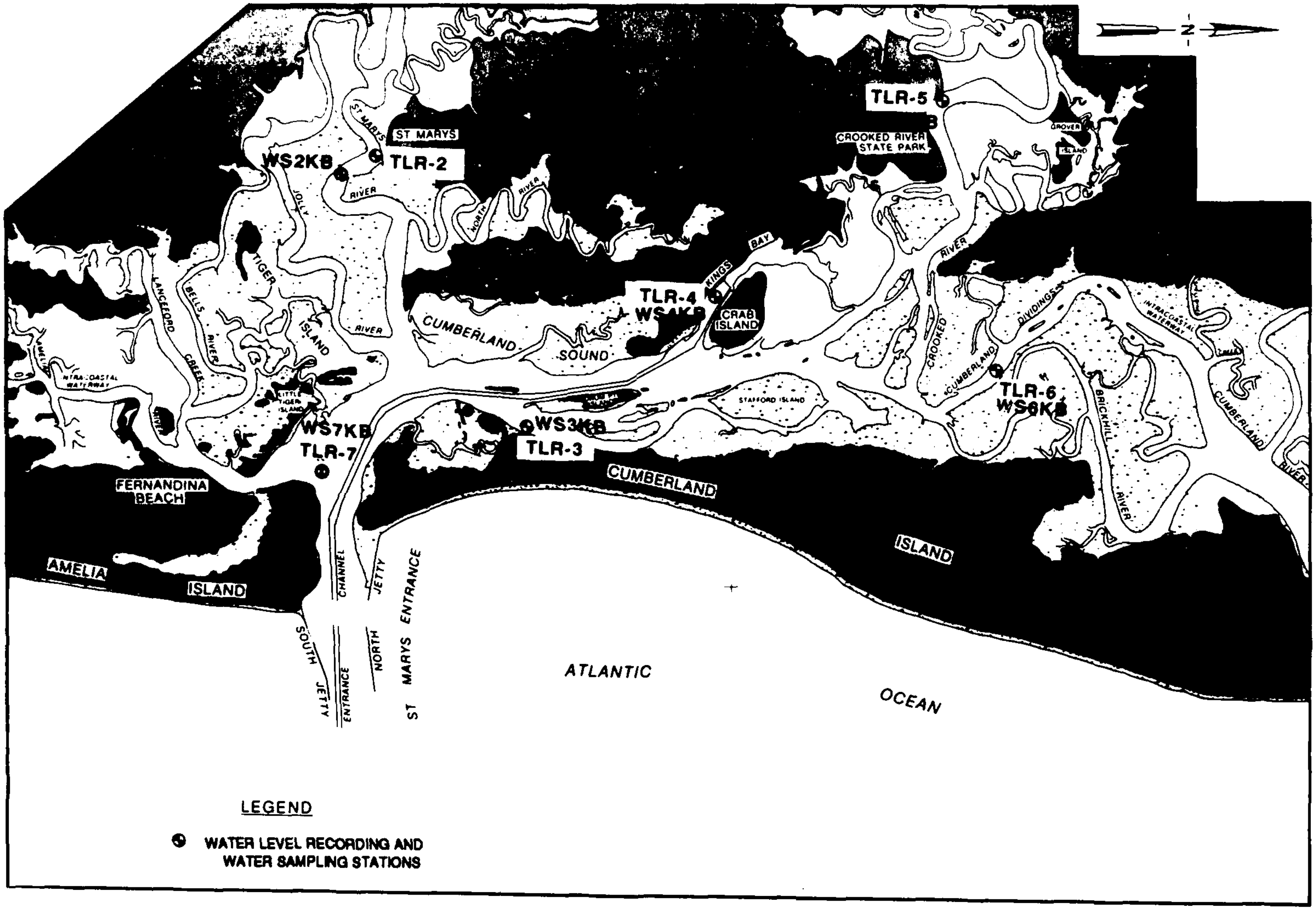


Figure 3. Locations of Cumberland Sound water level recording and water sampling stations

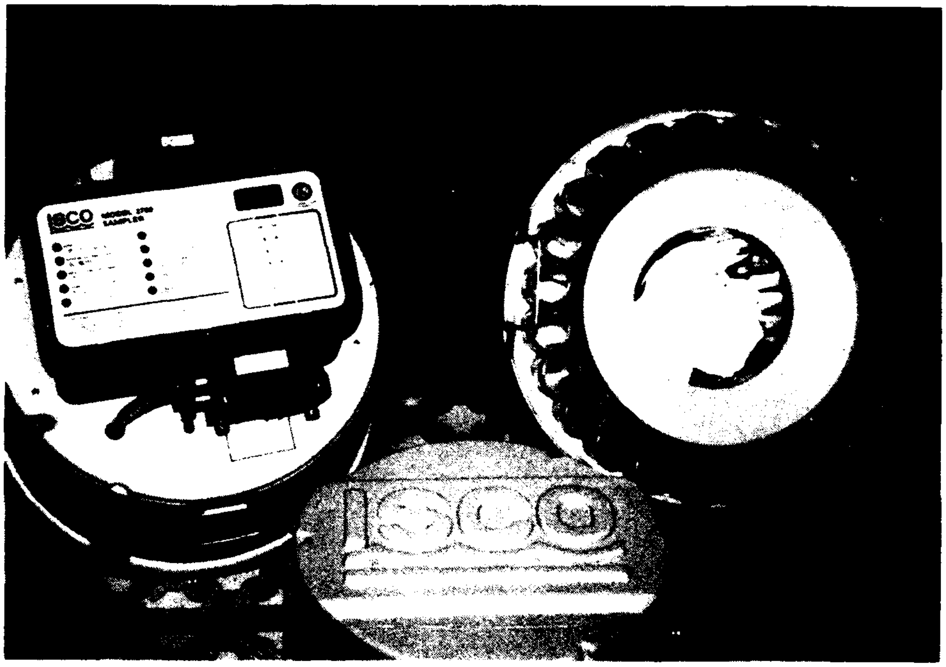


Figure 4. Automatic water sampler

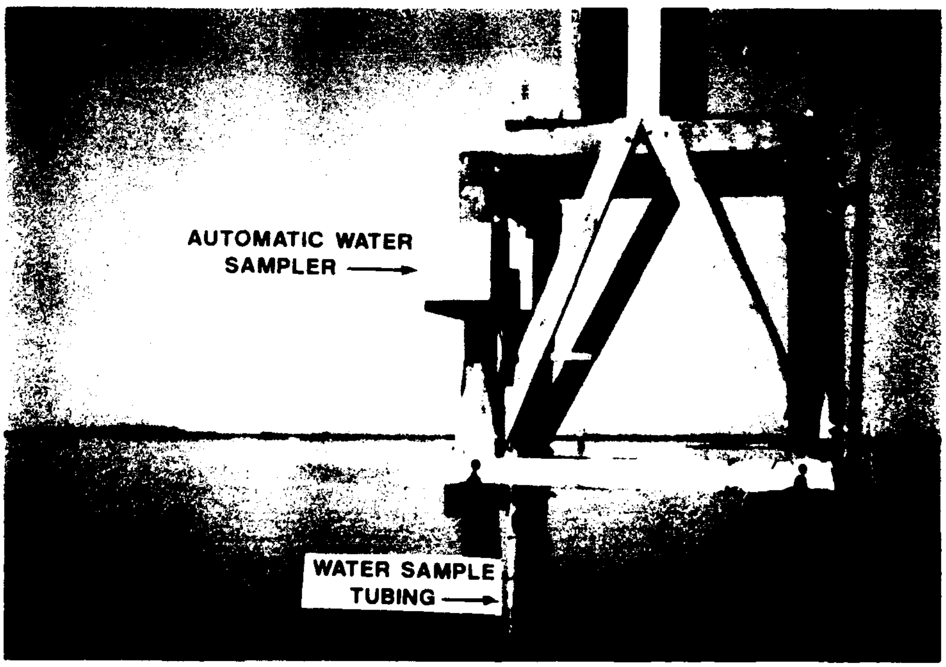


Figure 5. Typical field installation of automatic water sampler

St. Marys River near St. Marys, Georgia; near Crooked River State Park on the Crooked River; at the Kings Bay Submarine Base; on channel marker 59 at the junction of Crooked and Cumberland Rivers; and at the Dungeness dock on Cumberland Island. All the samplers were set up to collect subsamples at a point located at three-quarters of the depth at the sampler location.

13-hr Survey Data Collection Equipment

Current speed and direction measuring

17. Each boat used in the survey was outfitted to deploy instruments over the side using portable equipment as shown in Figure 6. Collapsible aluminum frames and winches (with 1/8-in. wire rope) were used to raise and lower the velocity and direction equipment. An indicator on the winch displays the depth of the instrument below the water surface. Gurley Model 665 vertical axis cup-type impeller velocity meters with direct velocity read-out capability were used to measure the current speeds. These meters have a threshold speed of less than 0.2 fps and an accuracy of ±0.1 fps for velocities less than 1 fps. Current directions were monitored with magnetic directional indicators mounted above the velocity meters on solid suspension bars. These assemblies were connected to streamlined lead weights that held the sensors in vertical positions and oriented them into the direction of flow. Signal cables from the instruments were raised and lowered with the equipment and connected to the display units located aboard each boat.

18. In addition to these current speed and direction measurements, fixed-depth current speed and direction, temperature, conductivity, and salinity were also measured at six locations throughout the Cumberland Sound using ENDECO 174 SSM meters. These instruments are self-contained recording current meters that float horizontally at the end of a tether, as shown in Figure 7, measuring current speed with a ducted impeller and direction with an internal compass. The ENDECO 174 also measures temperature with a thermilinear thermistor and conductivity with an induction-type probe. Data are recorded on an internal solid state memory datalogger which is also used to control the functions of the meter. (Locations of these instruments are shown in Figure 9, page 16.) Manufacturer-provided calibrations and processing software were used to convert the raw data. These instruments were deployed during the time of the 13-hr surveys to provide data supplemental to the longer term

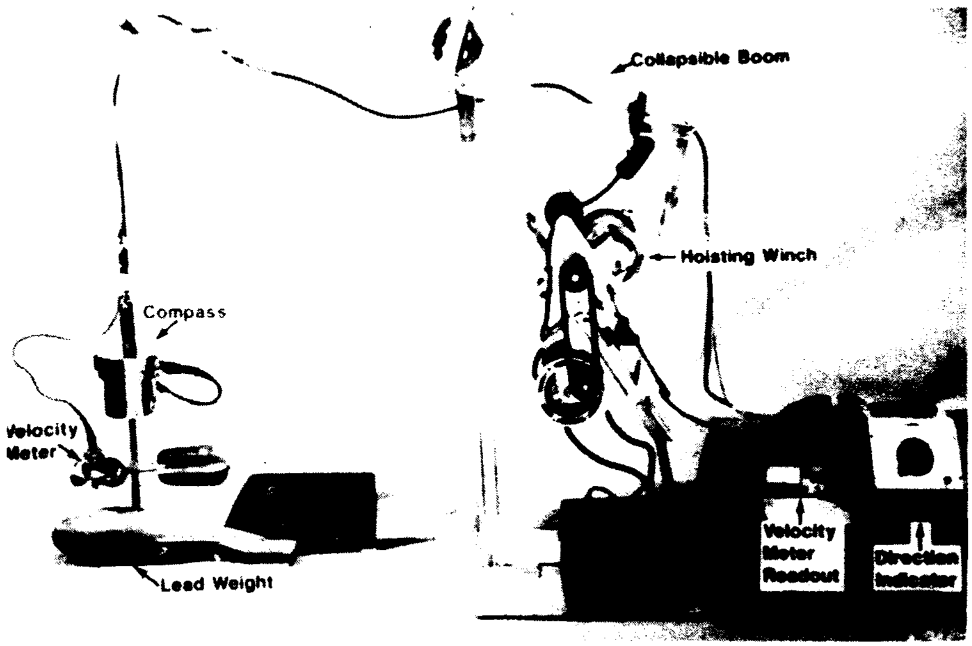


Figure 6. Over-the-side hydrodynamic data collection equipment

Figure 7. ENDECO 174 SSM current meter

deployment of ENDECO 1152 gages previously discussed.

Suspended sediment and salinity water sampling

19. Discrete water samples for analyses of salinities and total suspended solids were obtained at each depth where a velocity reading was taken by pumping the sample from the depth to the surface collection point. Pumping systems consisted of 1/4-in. ID plastic tubing attached to the current meter signal cables for support. One end of the sampling tube was attached to the solid suspension bar at the same elevation as the current meter and oriented into the flow. Twelve-volt d-c pumps were used to pump the water through 50 ft of tubing to the deck of the boat where each sample was collected in individual 8-oz plastic bottles. The pumps and tubing were flushed for approximately 1 min at each depth before collecting each sample.

Bottom sediment sampling

20. Bottom sediment samples were obtained using a clamshell bottom sampler. The samples were then brought to the surface and placed in wide-mouth plastic containers and sealed for storage until laboratory analysis of the samples could be performed. Bottom samples were obtained at each data collection range (1-8) in the study area. (Range locations are given in paragraph 23.)

Suspended sediment fall velocity sampling

21. A horizontal Niskin (registered trademark) sampler (Figure 8) was used to collect water samples for field determination of suspended sediment fall velocities. The open sampler was lowered to 3 ft above the bottom by a winch and cable system on the boat. A weighted messenger was then attached to the winch cable and released to trigger the mechanism used to close the sampler before it was brought back to the surface and aboard the boat. The sampler was then set in a vertical position and subsamples were withdrawn at the following times: 0, 4, 8, 16, 30, 45, 60, 90, 120, and 180 min. These subsamples were returned to the laboratory for determination of total suspended sediment. Laboratory records of percent material remaining in suspension versus time were used to calculate the suspended sediment fall velocities at ranges 4, 5, 7, and 8.

Meteorological data recording

22. Wind conditions prior to, during, and immediately following each of the 13-hr surveys were recorded using a HANDAR Model No. 540-A data acquisition system. Directions and speeds of the prevailing winds were recorded by a

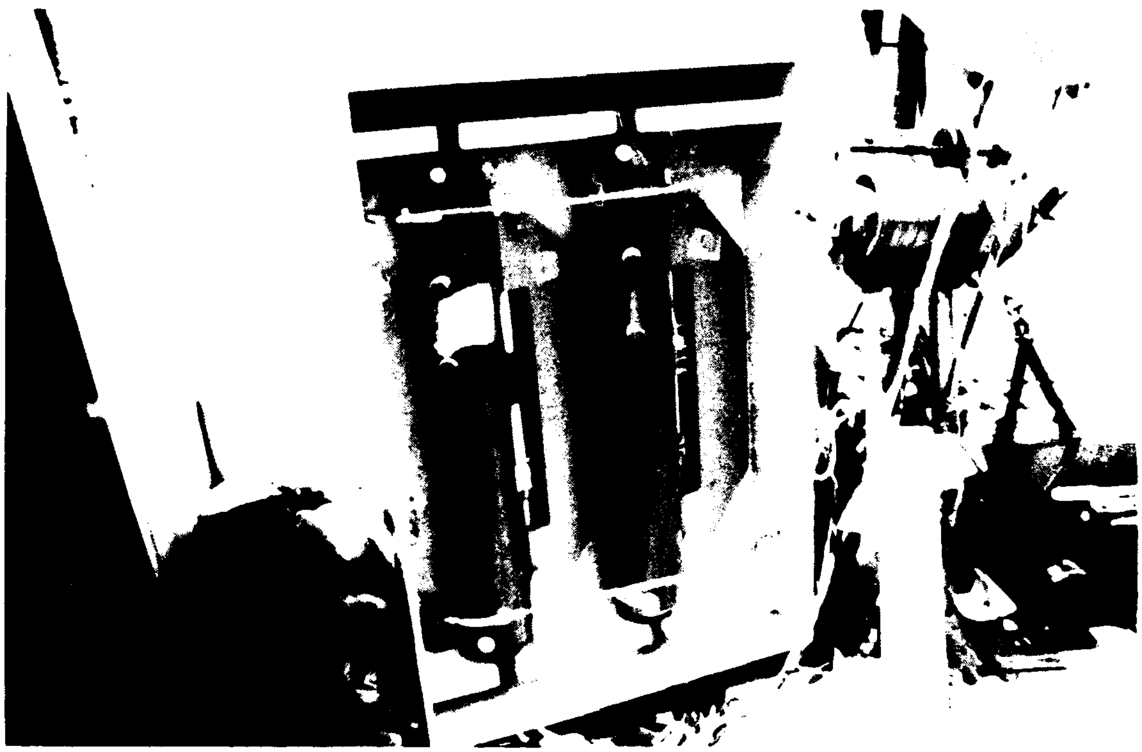


Figure 8. Niskin settling samplers

data collection platform on the east side of Cumberland Island at the National Park Services Dungeness Dock. The data acquisition system was a battery-powered microcomputer with a real-time clock, a serial data interface, and a programmable analog-to-digital converter. Twelve times each hour the system sampled the input signals from the wind speed and direction sensors. The system was also programmed to sample the input signals each second over four 15-min periods each hour to determine the mean wind speed, mean direction, maximum gust speed, and maximum gust direction. The data were then processed and stored in formats specified in a user-entered output table. The accuracy of the analog input of the system is ±0.1 percent of full scale.

Procedures

23. For the two 13-hr data collection periods, seven ranges in the sound were selected to provide maximum coverage of the study area and meet the needs of the monitoring plan. The general locations of these ranges are shown in Figure 9. Range 1, located at the southern end of the sound just above channel marker buoy 22, in the St. Marys entrance had four stations equally spaced across the channel. Stations 1B and 1C were located at the edges of

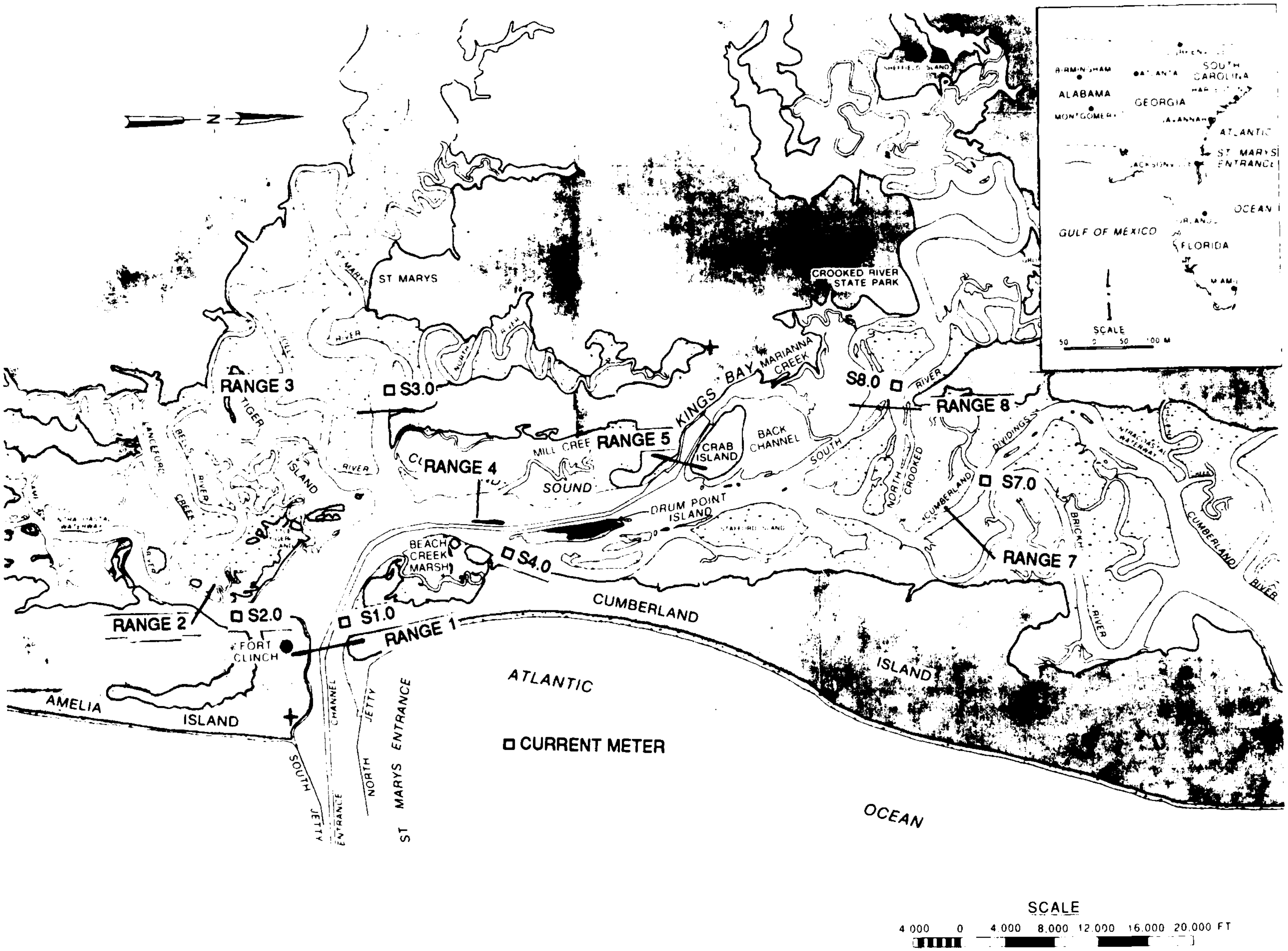


Figure 9. Cumberland Sound data collection ranges and current meter locations

the navigation channel and stations 1A and 1D at positions outside of the channel. Range 2, located near channel marker 28 in the Amelia River near Fernandina Beach, FL, also had four stations equally spaced across the range. Range 3, located in the St. Marys River approximately 1.5 miles west of the mouth of the St. Marys river entrance into Cumberland Sound, had three stations equally spaced across the range. Range 4 (four stations) was located at the southern end and on the westernmost side of Drum Point Island. Range 4 served as the swing range for the data collection in which data were collected at this location during both periods. Range 5 (three stations) was located immediately inside the entrance to the Kings Bay submarine base. Range 7 (four stations) was located at the entrance of the Cumberland River into Cumberland Sound. Range 8 (three stations) was located in the Crooked River near the separation of the river into two channels. It should be noted that there was no range 6 during the data collection period. The numbering sequence for the ranges followed those of a previous data collection effort (1985) and range 6 was omitted in this study to maintain consistency in the data collection ranges nomenclature.

24. In addition to the data collection ranges, six locations were designated for deployment of moored current meters at or near the data collection ranges. They are identified by stations S1.0-S4.0 and S7.0-S8.0 as shown in Figure 9. Meters were deployed several days prior to the intensive data collection and retrieved several days after. Meters were attached to mooring assemblies at approximately three-quarter depth equivalents at each location. A typical meter deployment is presented as Figure 10.

25. Prior to the beginning of the survey, the boats assigned to each range deployed anchors and mooring lines at each of the stations. The mooring lines were attached to large inflated buoys for retrieving the lines during each sampling time. Boats moved into position at each of the buoys and used the anchored line to hold a steady position in the current while data were collected. At each station, velocity data and water samples were collected at three depths: near bottom, middepth, and near surface. At stations with depths greater than 30 ft, one-quarter-depth and three-quarter-depth samples and readings were also taken. Near-bottom measurements were made 2 ft above the actual bottom. Middepth measurements were obtained at actual middepth levels. Near-surface measurements were obtained 3 ft below the water surface. Each hourly data collection at each depth included current speed, current

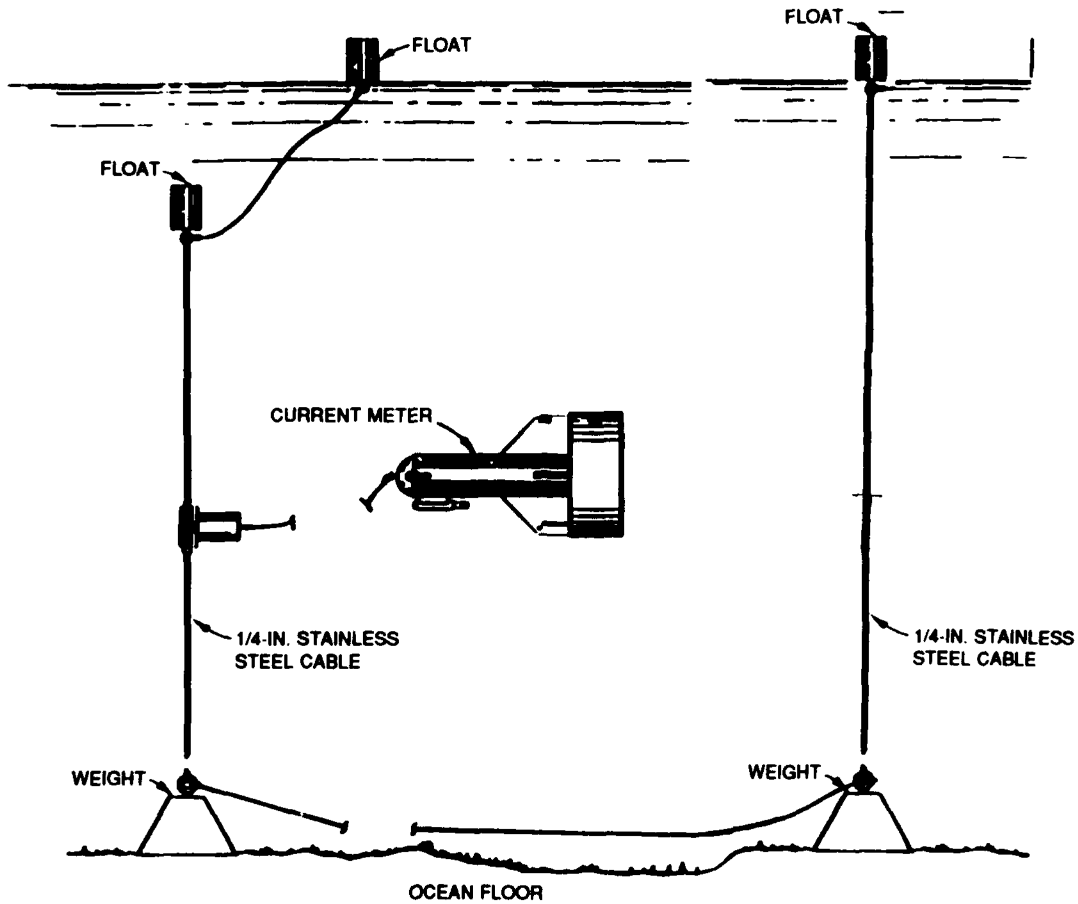


Figure 10. Typical current meter deployment

direction, and a pumped water sample for salinity and suspended sediment determination. These data are provided in Appendix A, Tables A1-A28.

Laboratory analysis of suspended sediments

26. The samples collected by the automatic water samplers, Niskin samplers, and those obtained at the individual sampling stations during the survey were analyzed in the laboratory at WES. After preweighing 0.4-μ polyester filters, 100 ml of each sample was drawn through the filters with a vacuum system. After the filters and holders were washed with distilled water, the filters were dried at 102-105 C for 1 hr and reweighed. Suspended sediment values in mg/l were determined by subtracting filter weights from filter plus sample weights and multiplying by 10 (Appendix A).

Laboratory analysis of salinity

27. Water samples analyzed for suspended sediments were also analyzed to determine salinity. An AGE Instruments, Incorporated, Model 2100 MINISAL salinometer with automatic temperature and cell constant compensation was

used. The salinometer was calibrated with standard seawater and was accurate to within ±0.003 ppt. Data were measured in the laboratory to the nearest 0.01 ppt and are reported to the nearest 0.1 ppt (Appendix A).

Conditions of the survey

28. The two 13-hr data collection periods encompassed entire tide cycles during maximum fortnightly tidal ranges (spring tides). The maximum tidal range measured during the survey was 7.02 ft at station TLR-6 in the upper reaches of the bay (Cumberland River) (Table 1). Average tidal range increased from 5.5 ft at St. Marys entrance to 6.5 ft at the Cumberland River station (Table 1). Calm and clear weather conditions prevailed during the survey. Wind conditions during the survey ranged from a slight breeze to light winds of 10-15 mph, predominantly from the northeast (Plates 1 and 2).

PART III: DATA PRESENTATION

Water Level Data

29. Maximum and minimum water level elevations observed during the survey are presented in Table 1. Plots of the water level data for periods of several days prior to and 12 hr following the survey period are shown in Plates 3-8. Water level recorders TLR 3-TLR 7 appeared to function properly during the survey period. The recorder at station TLR-2 ceased to operate after 1100 on May 6, thereby preventing collection of data during the 13-hr surveys.

30. The data from TLR-7 were used as reference for comparison with the data from the other stations in order to estimate tidal phase and range differences between the entrance to and the upper reaches of Cumberland Sound. Tidal ranges showed significant variation during the survey period, ranging from a mean range of 5.52 ft at St. Marys entrance to 6.51 ft in Cumberland River at the north end of the sound (Table 1). Mean and plus or minus one standard deviation of the differences in tidal phase, measured as the differences between times of high and low water at each station and the entrance, were: Dungeness Dock, +6 ± 11 min; Kings Bay Service Dock, +9 ± 9 min; Channel Marker 59 in Cumberland River, +24 ± 14 min; and Crooked River State Park, +60 ± 8 min.

Over-the-Side Current Speed and Direction Data

31. Appendix A, Tables A1-A28, are time series listings of the over-the-side current speed data obtained at the seven ranges as described in paragraph 23. Plates 9-36 are plots of the velocity data for each range for the cycle of the tide (ebb and flood) during the survey periods. The maximum velocity observed was 4.3 fps near the surface at station 1B. Plots of the moored current meter data are shown in Plates 93-98.

32. The minor freshwater inflow from the rivers local to this area did not contribute significantly to flow in the channel. As a result, there were no large variations, other than tidal, in the magnitude and direction of the currents. Eddies and unusual flow circulation patterns created by change in the tidal periods were observed; however, the changes within the system were

not always detectable using the hourly observation schedule of this study.

Salinity Data

33. Salinity data from the over-the-side surveys are listed in Appendix A, Tables A1-A28, and plots are shown in Plates 37-64. Plots of salinities measured from the moored current meter deployments are also shown in Plates 93-98. Salinity values at the sampling locations within Cumberland Sound indicate that flow within ranges 3, 4, and 5 was partly to well mixed while at ranges 1, 2, 7, and 8 flow was generally well mixed.

Suspended Sediment Data

34. Suspended sediment concentrations are shown in Appendix A and in Plates 65-92. Generally, samples collected from the bottom at the time of the strength of flood or ebb flow showed the highest suspended sediment concentrations. Suspended sediment concentrations near the bottom within shallow areas tended to be lower than those observed in the channel during the peak velocity periods of ebb and flood tides. However, a slight increase occurred in the surface concentrations in some shallow areas during the strengths of ebb and flood. It is not readily apparent whether or not surface wave conditions within the bay were a significant factor influencing suspended sediment levels during the survey.

35. Suspended sediment concentrations of samples obtained from the automatic samplers are listed in Table 2. Stations WS2KB, WS4KB, and WS7KB typically showed the lowest suspended sediment concentrations, with mean concentrations of 23 mg/l or less (Table 2). Stations WS3KB and WS5KB showed mean concentrations of 38 mg/l and 30 mg/l, respectively. The highest concentrations were recorded at stations WS3KB and WS6KB, with means of 38 mg/l and 63 mg/l, respectively (Table 2). These stations also showed the largest variability in suspended sediment levels, reflected by the standard deviations listed in Table 2.

36. Average data collected from the over-the-side surveys at the seven ranges are listed in Tables 3-10. These average data are useful for comparison between ranges, and stations along each range. Depth-dependent gradients of current speed, salinity, and suspended sediments were present at most

monitoring stations. Well-defined depth gradients of current speed were recorded at almost every range and station. The highest average currents, and greatest differences between surface and bottom current speeds for flood and ebb flows were present at range 1 (Table 3). Average surface current velocities exceeded 2.0 fps at range 1. Surface velocities during the ebb tide averaged approximately 1 fps higher at the surface than at the bottom (Table 3). Most stations along the other ranges showed differences of surface and bottom current speeds of approximately 0.5 fps. Hydrodynamic depth gradients were calculated by dividing the difference between the average surface and bottom hydrodynamic parameters (current speed, salinity, suspended sediments) by the difference between the surface and bottom measurement depths. This calculation revealed the average change in each parameter per foot of water depth (Table 11). The lowest current speed gradients were recorded at range 5 and within the navigation channel at range 4 (Tables 6-8). The highest current speed depth gradients occurred at ranges 3, 7, and 8, and the shallow-water portion of range 4 (stations A and B). The highest salinity gradients occurred at ranges 4 and 5, where up to 1 ppt or greater differences between the average surface and average bottom salinity were recorded (Tables 6-8). Almost no salinity gradients were observed at range 7 and range 8 (Tables 9 and 10). Surface and bottom salinity differences of only a few tenths of a ppt salinity were recorded at ranges 1-3 (Tables 3-5), although the relatively shallow water of range 3 resulted in a fairly high salinity depth gradient (Table 11). Trends in the average suspended sediment data were similar to the trends in salinity (Tables 3-10). The highest suspended sediment ranges also occurred at range 5 and the channel portion of range 4, where surface and bottom values differed by 30 to 40 mg/l or more (Tables 6-8). Despite the relatively deeper water of these areas, the depth gradients of suspended sediments were also among the highest in these locations (Table 11). The highest suspended sediment depth gradient occurred at range 8, where 1.6 mg/l per foot of depth was recorded (Table 11).

Suspended Sediment Fall Velocities

37. Suspended sediment fall velocities were calculated from Niskin tube sampling at ranges 4, 5, 7, and 8. Because the suspended sediment levels were generally low within the study area during the field data collection efforts,

calculation of sediment fall velocities was subject to a greater potential for error. The sample collected at range 5 was particularly sensitive to errors caused by low concentration. The samples from ranges 4, 7, and 8 had starting suspended sediment levels ranging from 55 to 58 mg/l, compared with only 16 mg/l for range 5. Table 12 lists the 40, 50 (median), and 60 percentile fall velocities for these four ranges. Samples from ranges 7 and 8 had the highest fall velocities, indicated by the highest median values of the four samples. Particle size distribution was apparently highest in the sample from range 5, as indicated by the wide range of fall velocities from the 40 to the 60 percentile.

Bottom Sediment Classification

38. The bottom sediment samples collected by grab sampler were classified by visual analysis in the laboratory. These descriptions and classifications are listed in Table 13. Sandy or shelly sediments dominated most ranges, attributed to effective winnowing by tidal currents. The relatively quiescent conditions at range 5 contribute to the deposition of predominantly muddy sediments.

PART IV: SUMMARY

39. The majority of data presented in this report were collected during two 13-hr intensive hydrodynamic surveys on 7 and 8 May 1990. Supplemental data from longer term sampling efforts within Cumberland Sound are also included for several days before and/or after the 2-day intensive surveying. The following general observations were made of the data:

a. The average tidal range measured at St. Marys entrance was 5.5 ft. Tidal range increased toward the north within Cumberland Sound, with a maximum average range of 6.5 ft recorded at Cumberland River. Tidal phase difference (lag) from the entrance to Kings Bay was only 9 min. However, the phase lag was 24 min to range 8 and 1 hr to Crooked River State Park. Mostly light winds during the survey did not appear to cause large variations in tidal range or phase.

b. Over-the-side surveys in conjunction with automated gaging indicated that water velocities were influenced predominantly by tidal flow, with only minor flow attributed to freshwater runoff from St. Marys and Crooked Rivers. Average surface current velocities varied from over 2 fps at St. Marys entrance to approximately 1.5-2 fps along the other ranges, with the exception of range 5 (Kings Bay) where surface currents averaged 0.6 fps. Current-depth gradients, the difference between average surface and bottom currents divided by the depth, were highest at range 3 (St. Marys River), range 7 (mouth of Crooked River), range 8 (Cumberland River), and the shallow water stations of range 4 (Cumberland Sound at Drum Point Island). The lowest current-depth gradients occurred at range 5 and the navigation channel portions of range 4.

c. Average salinities within Cumberland Sound varied from approximately 33 ppt at St. Marys entrance to 28 ppt at the north end of the sound. Salinity-depth gradients were moderately well developed at ranges 3, 4, and 5, where average salinity increased approximately 0.03 ppt for every foot of water depth, compared with less that 0.005 ppt at ranges 1, 7, and 8. Maximum differences between surface and bottom salinities approached 3 ppt within the channel at range 4 on 7 May. These extreme ranges occurred near ebb tide. Maximum salinity differences along the other ranges were not as high and did not seem to follow a definite trend in relation to the tidal stage.

d. Suspended sediment loads within the waters of Cumberland Sound were low during the survey period, averaging less than 20 mg/l. However, areal, vertical, and temporal variations in sediment levels were recorded. Average levels varied from approximately 14 mg/l at range 5 to 27 mg/l at range 8. The greatest variation in suspended sediment values occurred vertically, related to the tidal cycle. It was not uncommon for the near-bottom suspended sediment values to be three times or more than the surface values during portions of the tidal cycle, particularly

the first reading after the occurrence of peak ebb or flood currents. An average median sediment particle fall velocity of approximately 0.5 mm/sec was recorded at ranges 4, 5, 7, and 8.

Table 1

Maximum and Minimum Water Levels and Salinity Data

Station	Tide*	Date m/day	Time hh:mm	Temp °C	Salinity ppt	Water Level (ft, mlw)
TLR-7 St. Marys	L	5/7	00:40	23.9	30.3	0.65
Entrance Marker	H	5/7	06:50	22.1	33.2	5.80
	L	5/7	12:50	23.9	30.2	0.77
Mean	H	5/7	19:20	22.6	33.0	6.53
Tidal 5.52 ft	L	5/8	01:30	23.5	30.3	0.56
Range	H	5/8	07:20	22.3	33.1	5.54
	L	5/8	13:20	23.9	29.9	0.11
	H	5/8	20:00	22.9	33.0	6.40
TLR-3 Dungeness Dock	L	5/7	00:40	24.2	28.3	0.49
Cumberland Island	H	5/7	07:00	23.3	30.9	5.97
	L	5/7	13:10	24.8	28.4	0.70
Mean	H	5/7	19:30	23.1	31.5	6.76
Tidal 5.85 ft	L	5/8	01:30	23.8	28.4	0.38
Range	H	5/8	07:40	23.2	30.6	5.75
	L	5/8	13:20	24.7	28.7	-0.03
	H	5/8	19:50	23.3	31.2	6.59
TLR-4 Kings Bay Dock	L	5/7	00:40	24.3	28.7	0.38
	H	5/7	07:10	24.2	29.3	6.36
	L	5/7	13:00	24.2	29.2	0.39
Mean	H	5/7	19:40	24.3	29.7	6.73
Tidal 6.21 ft	L	5/8	01:30	23.8	29.3	0.37
Range	H	5/8	07:25	23.7	29.1	5.99
	L	5/8	13:20	24.3	29.2	-0.69
	H	5/8	20:20	24.2	29.3	6.61
TLR-5 Crooked River	L	5/7	01:40	25.2	26.2	-1.33
State Park	H	5/7	07:50	24.5	26.1	4.37
	L	5/7	13:40	25.3	26.1	-1.35
Mean	H	5/7	20:30	24.9	27.7	5.13
Tidal 6.17 ft	L	5/8	02:30	24.6	26.3	-1.36
Range	H	5/8	08:30	24.2	26.0	4.20
	L	5/8	14:10	25.0	26.2	-2.01
	H	5/8	21:00	24.7	27.9	5.04
TLR-6 Channel Marker	L	5/7	01:00	25.1	26.7	0.92
59, Cumberland	H	5/7	07:25	24.4	26.6	7.03
River	L	5/7	13:00	24.6	27.0	1.16
	H	5/7	20:00	24.9	27.2	7.84

(Continued)

* L - Low water reading.
H - High water reading.

Table 1 (Concluded)

Station		Tide	Date m/day	Time hh:mm	Temp °C	Salinity ppt	Water Level (ft, mlw)
Mean		L	5/8	01:30	24.4	26.8	0.82
Tidal	6.51 ft	H	5/8	08:00	24.0	27.0	6.86
Range		L	5/8	13:40	24.5	26.9	0.38
		H	5/8	20:30	24.5	27.4	7.76

Table 2

Automatic Water Sampler Suspended Sediment Data

Date	Time Interval Start	Time Interval End	Suspended Sediment, mg/l WS2KB	WS3KB	WS4KB	WS5KB	WS6KB	WS7KB
7 May	0700	0900	20	36	14	22	61	28
	1000	1200	32	23	13	25	97	25
	1300	1500	18	22	16	29	49	20
	1600	1800	24	49	10	42	60	37
	1900	2100	25	41	20	24	87	14
	2200	2400	36	36	14	46	64	19
8 May	0100	0300	23	18	32	24	101	23
	0400	0600	16	20	24	24	33	27
	0700	0900	21	51	14	17	56	19
	1000	1200	23	33	11	27	106	24
	1300	1500	18	29	14	38	57	19
	1600	1800	20	85	13	36	45	19
	1900	2100	24	51	11	29	64	9
	2200	2400	31	50	14	15	36	16
9 May	0100	0300	33	47	17	46	71	19
	0400	0600	21	33	14	26	30	17
	0700	0900	20	24	20	32	56	16
Mean:			23	38	16	30	63	22
Standard Deviation:			9	16	5	9	22	8
Minimum:			16	18	10	15	30	9
Maximum:			36	85	32	46	106	37

Table 3

Data Averages for Range 1

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 1A					
Surface	3.0	2.6	2.8	32.6	11
1/4 depth	12.8	2.8	2.6	32.7	15
Middepth	25.8	2.3	2.4	32.8	17
3/4 depth	38.3	2.0	2.2	32.9	19
Bottom	49.1	1.6	1.9	32.8	29
Station 1B					
Surface	3.0	2.6	2.8	32.6	9
1/4 depth	16.2	2.5	2.8	32.7	13
Middepth	32.1	2.5	2.5	32.8	14
3/4 depth	48.3	2.2	2.1	32.9	16
Bottom	62.1	1.7	1.5	32.9	18
Station 1C					
Surface	3.0	2.6	2.4	32.7	10
1/4 depth	14.8	2.2	2.2	32.7	12
Middepth	29.6	1.9	2.3	32.8	15
3/4 depth	44.4	1.8	1.8	32.9	17
Bottom	57.7	1.4	1.4	32.8	17
Station 1D					
Surface	3.0	2.5	1.7	32.7	22
1/4 depth	9.3	2.4	1.6	32.7	24
Middepth	18.5	1.8	1.6	32.8	25
3/4 depth	29.2	1.5	1.3	32.8	26
Bottom	35.1	1.1	1.4	32.8	20

Table 4

Data Averages for Range 2

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 2A					
Surface	3.0	1.7	1.2	32.1	11
1/4 depth	11.8	1.5	1.5	32.3	15
Middepth	23.6	1.2	1.8	32.4	17
3/4 depth	35.4	1.1	1.5	32.4	19
Bottom	45.2	0.6	1.0	32.5	24
Station 2B					
Surface	3.0	1.4	1.6	32.1	11
1/4 depth	9.9	1.4	1.8	32.3	13
Middepth	19.0	1.2	1.8	32.4	17
3/4 depth	30.1	1.1	1.5	32.4	21
Bottom	37.7	0.7	0.9	32.5	30
Station 2C					
Surface	3.0	1.6	1.6	32.2	15
Middepth	13.1	1.5	1.3	32.3	19
Bottom	24.1	0.7	0.9	32.4	31

Table 5

Data Averages for Range 3

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 3A					
Surface	3.0	1.7	1.7	30.3	11
Middepth	12.4	1.4	1.4	30.6	17
Bottom	22.4	1.1	1.1	30.9	28
Station 3B					
Surface	3.0	1.6	1.4	30.3	14
Middepth	10.5	1.4	1.4	30.5	20
Bottom	19.1	0.9	1.1	30.7	27
Station 3C					
Surface	3.0	2.0	1.0	30.5	12
Middepth	11.1	1.3	1.3	30.5	16
Bottom	20.4	1.0	0.8	30.7	25

Table 6

Data Averages for Range 4, 7 May 1990

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 4A					
Surface	3.0	1.8	1.2	29.7	11
Middepth	11.2	1.4	1.2	30.1	14
Bottom	20.4	0.9	1.1	30.2	23
Station 4B					
Surface	3.0	2.2	1.2	29.7	7
Middepth	13.5	1.6	1.4	30.1	10
Bottom	25.0	1.0	1.2	30.6	18
Station 4C					
Surface	3.0	1.8	1.6	29.9	5
1/4 depth	12.2	1.8	1.6	30.2	8
Middepth	24.5	1.5	2.1	30.7	11
3/4 depth	36.7	1.1	2.1	31.4	20
Bottom	46.9	0.7	1.5	31.5	40
Station 4D					
Surface	3.0	1.8	1.8	30.1	6
1/4 depth	12.2	2.2	1.4	30.4	7
Middepth	24.5	1.4	1.8	30.8	9
3/4 depth	36.4	1.0	1.0	32.0	12
Bottom	46.2	0.7	1.3	31.7	39

Table 7

Data Averages for Range 4, 8 May 1990

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 4A					
Surface	3.0	1.2	1.2	29.8	13
Middepth	9.1	1.0	1.2	30.0	21
Bottom	16.4	0.8	0.8	30.1	29
Station 4B					
Surface	3.0	1.9	1.4	29.9	11
Middepth	12.8	1.7	1.5	30.2	14
Bottom	23.5	1.1	1.1	30.3	31
Station 4C					
Surface	3.0	1.9	1.7	30.1	13
1/4 depth	10.7	1.7	1.5	30.1	12
Middepth	21.0	1.4	1.8	30.4	14
3/4 depth	32.1	1.3	1.5	30.8	22
Bottom	39.9	0.7	1.1	30.9	45
Station 4D					
Surface	3.0	1.8	1.8	30.2	7
1/4 depth	12.7	1.8	1.8	30.3	9
Middepth	25.3	1.7	1.7	30.5	11
3/4 depth	39.0	1.2	1.2	31.7	14
Bottom	48.6	0.7	1.5	31.0	34

Table 8

Data Averages for Range 5

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sed ment mg/l
Station 5A					
Surface	3.0	0.8	0.4	29.1	6
1/4 depth	11.3	0.6	0.2	29.5	7
Middepth	22.6	0.4	0.2	29.8	9
3/4 depth	33.9	0.2	0.4	30.0	18
Bottom	43.4	0.1	0.1	30.2	85
Station 5B					
Surface	3.0	0.8	0.4	29.0	5
1/4 depth	12.4	0.5	0.3	29.4	6
Middepth	25.0	0.3	0.3	29.9	10
3/4 depth	37.4	0.1	0.5	30.1	14
Bottom	47.9	0.1	0.3	30.4	48
Station 5C					
Surface	3.0	0.5	0.7	29.1	5
1/4 depth	12.7	0.5	0.5	29.5	6
Middepth	25.4	0.4	0.4	29.8	10
3/4 depth	38.1	0.2	0.6	30.1	14
Bottom	48.8	0.1	0.3	30.5	32

Table 9

Data Averages for Range 7

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 7A					
Surface	3.0	1.7	2.1	28.5	16
Middepth	16.0	1.6	2.0	28.5	17
Bottom	29.9	1.2	1.4	28.5	19
Station 7B					
Surface	3.0	2.2	1.6	28.4	19
Middepth	9.2	1.9	1.5	28.4	22
Bottom	16.3	1.6	1.2	28.4	21
Station 7C					
Surface	3.0	1.7	1.3	28.0	24
Middepth	6.6	1.3	1.7	28.0	26
Bottom	11.2	1.2	1.4	28.2	27
Station 7D					
Surface	3.0	1.4	1.6	28.1	26
Middepth	4.9	1.8	1.4	28.1	21
Bottom	7.3	1.1	1.1	28.1	29

Table 10

Data Averages for Range 8

Location	Depth ft	Current Speed fps Flood	Current Speed fps Ebb	Salinity ppt	Suspended Sediment mg/l
Station 8A					
Surface	3.0	0.8	1.4	28.3	19
Middepth	5.2	1.0	1.2	28.3	24
Bottom	8.1	0.6	1.2	28.3	31
Station 8B					
Surface	3.0	1.2	1.6	28.3	21
Middepth	9.3	1.1	1.3	28.3	33
Bottom	16.6	0.8	0.8	28.3	46
Station 8C					
Surface	3.0	1.4	1.6	28.3	17
Middepth	9.6	1.5	1.3	28.3	23
Bottom	17.1	1.0	1.0	28.3	33

Table 11

Average Hydrodynamic Parameter Depth Gradients*

Range No.	Current Speed fps/ft	Salinity ppt/ft x 10^{-3}	Sediment mg/l/ft
1	0.02	4.7	0.20
2	0.02	10.2	0.49
3	0.03	22.7	0.81
4A,B 7 May	0.03	35.5	0.58
4C,D 7 May	0.01	36.7	0.78
4A,B 8 May	0.03	20.6	1.06
4C,D 8 May	0.02	19.4	0.59
5	0.01	29.7	1.15
7	0.03	3.8	0.32
8	0.04	3.0	1.62

* Averages for all stations on each range.

Table 12

Suspended Sediment Particle Fall Velocities

Range No.	Particle Fall Velocity, mm/sec 40 Percentile	50 Percentile	60 Percentile
4	0.56	0.33	0.23
5	0.96	0.38	0.07
7	0.80	0.47	0.23
8	0.91	0.64	0.51

Table 13

Visual Descriptions of Bottom Sediment Samples

Range 1.	Light gray, shelly sand. Approximately 30% shell material, composed of oyster, *Mercenaria* sp., and others. Sand is medium to coarse quartz.
Range 2.	Medium gray, muddy/sandy shell hash. Approximately 50% shell, composed of oyster and others, 30 percent fine to coarse quartz sand, and 20% mud.
Range 3.	Light brown, medium to coarse quartz sand.
Range 4.	Two sediments. Medium gray-brown, slightly shelly, fine to medium sand. Dark gray, slightly shelly mud with trace of sand.
Range 5.	Very dark gray, cohesive mud.
Range 7.	Light gray-brown, fine to medium quartz sand.
Range 8.	Light gray, fine to medium sand with a few thin, muddy layers.

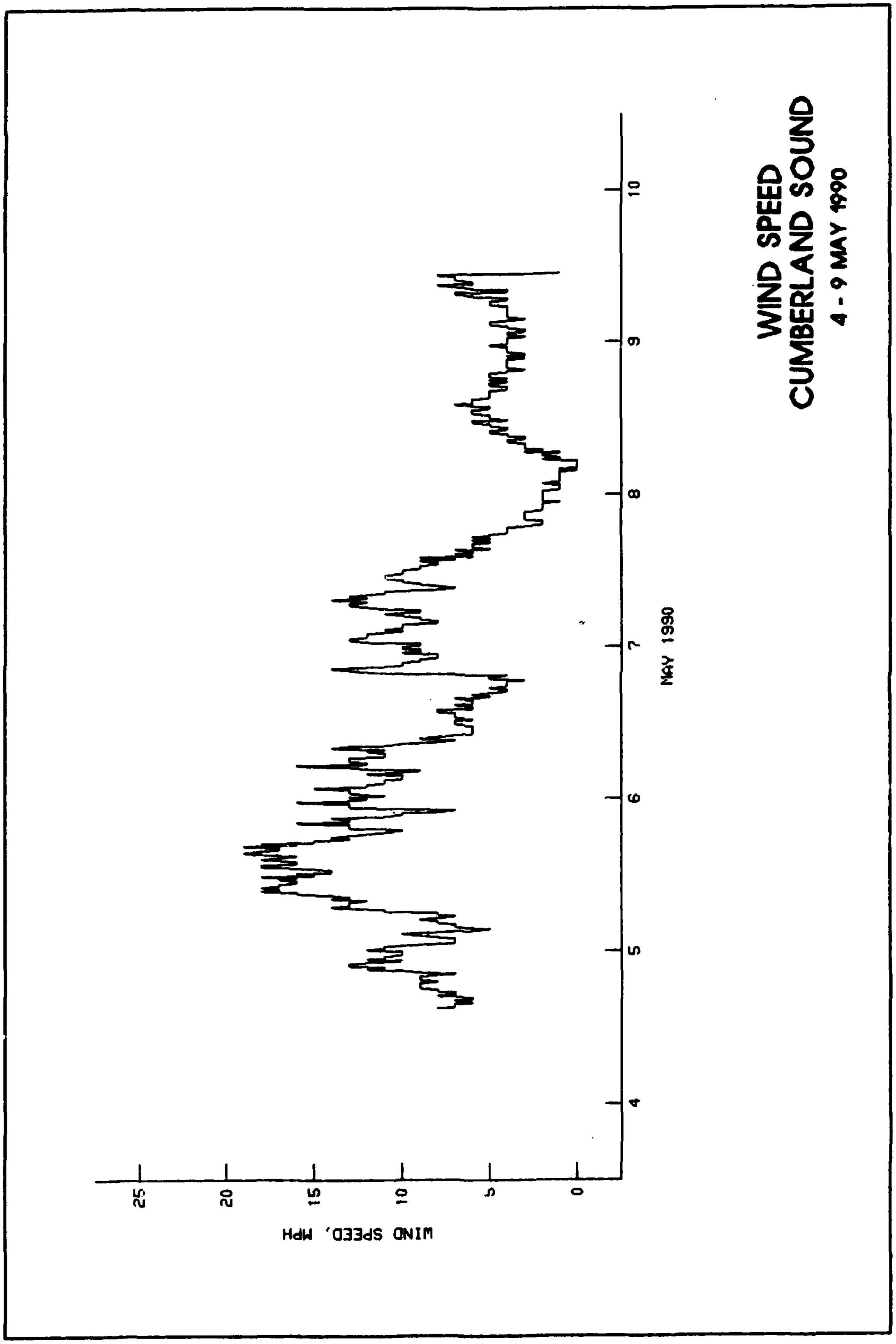
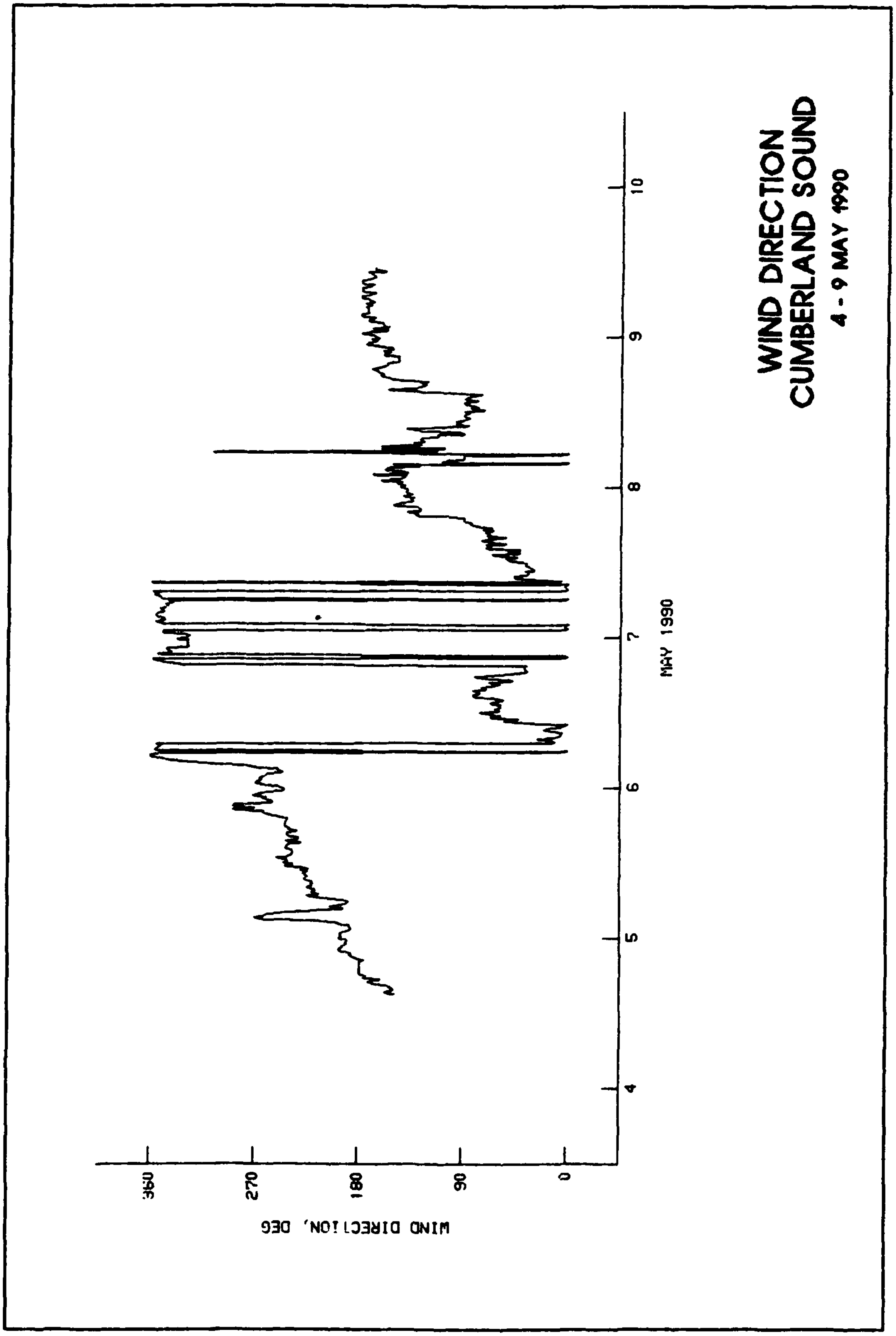

WIND SPEED
CUMBERLAND SOUND
4 - 9 MAY 1990
MAY 1990
WIND SPEED, MPH
0
5
10
15
20
25
4
5
6
7
8
9
10

PLATE 1


WIND DIRECTION
CUMBERLAND SOUND
4 - 9 MAY 1990
WIND DIRECTION, DEG
MAY 1990
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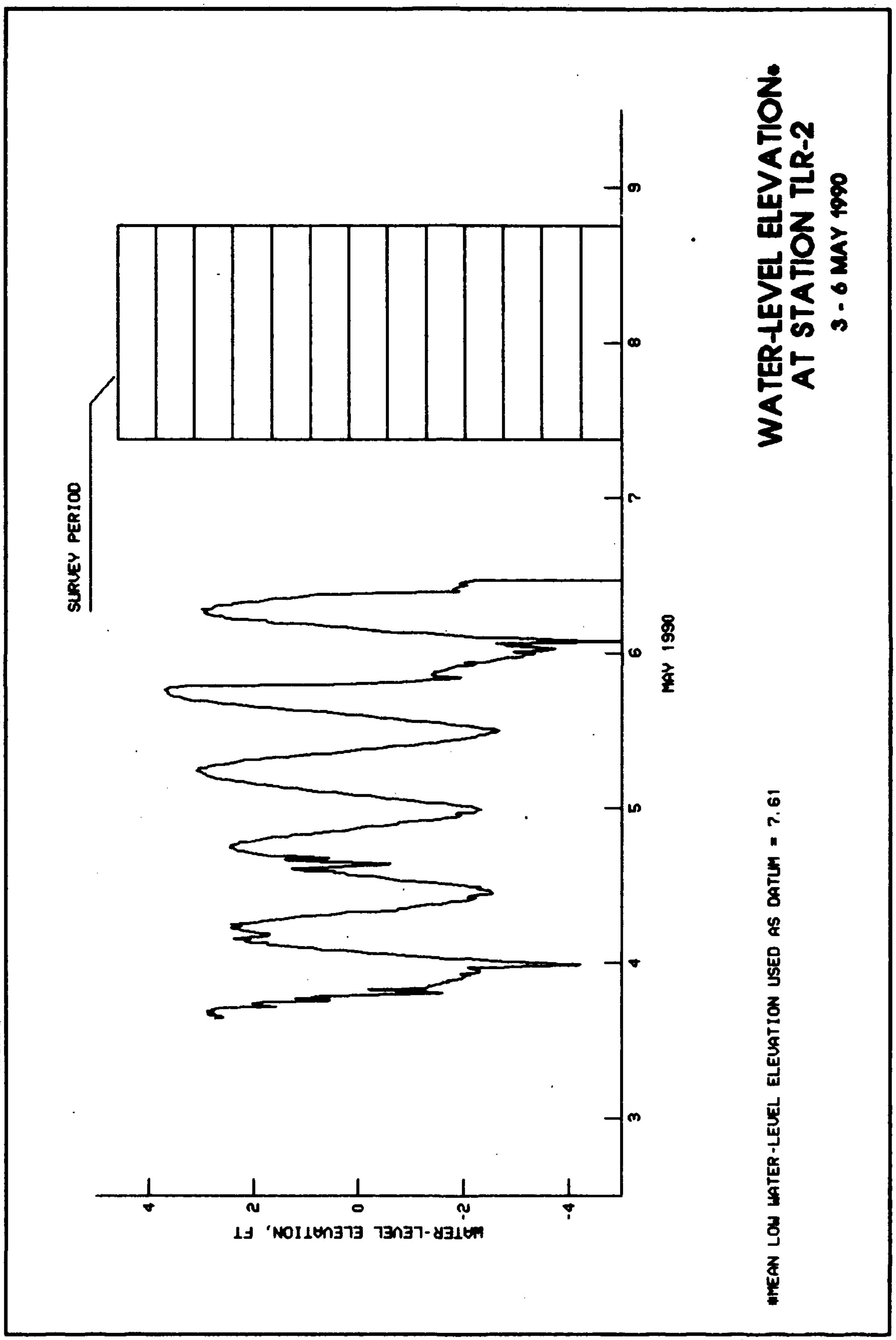
90
180
270
360
4
5
6
7
8
9
10

PLATE 2



WATER-LEVEL ELEVATION*
AT STATION TLR-2
3 - 6 MAY 1990

*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 7.61

PLATE 3

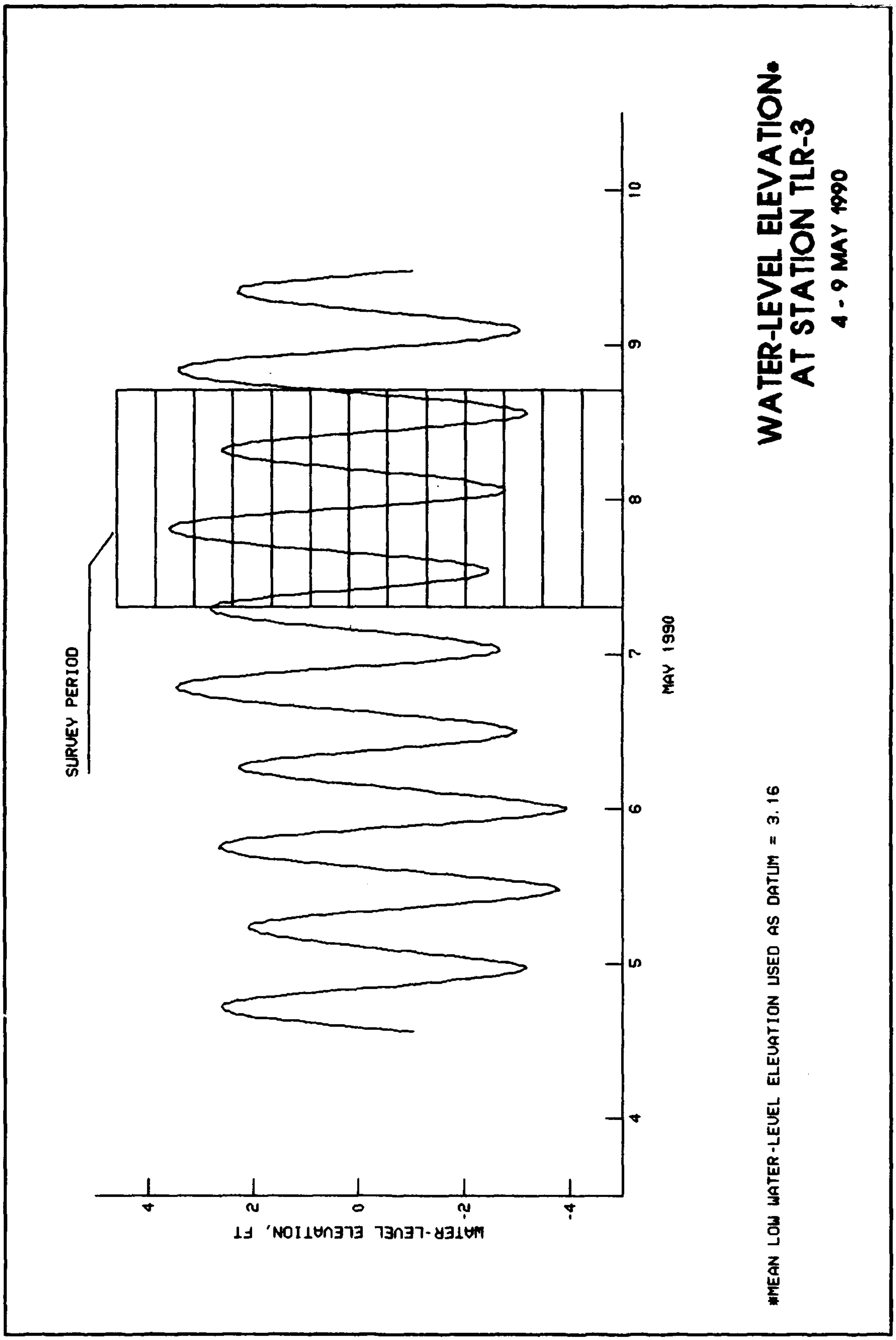
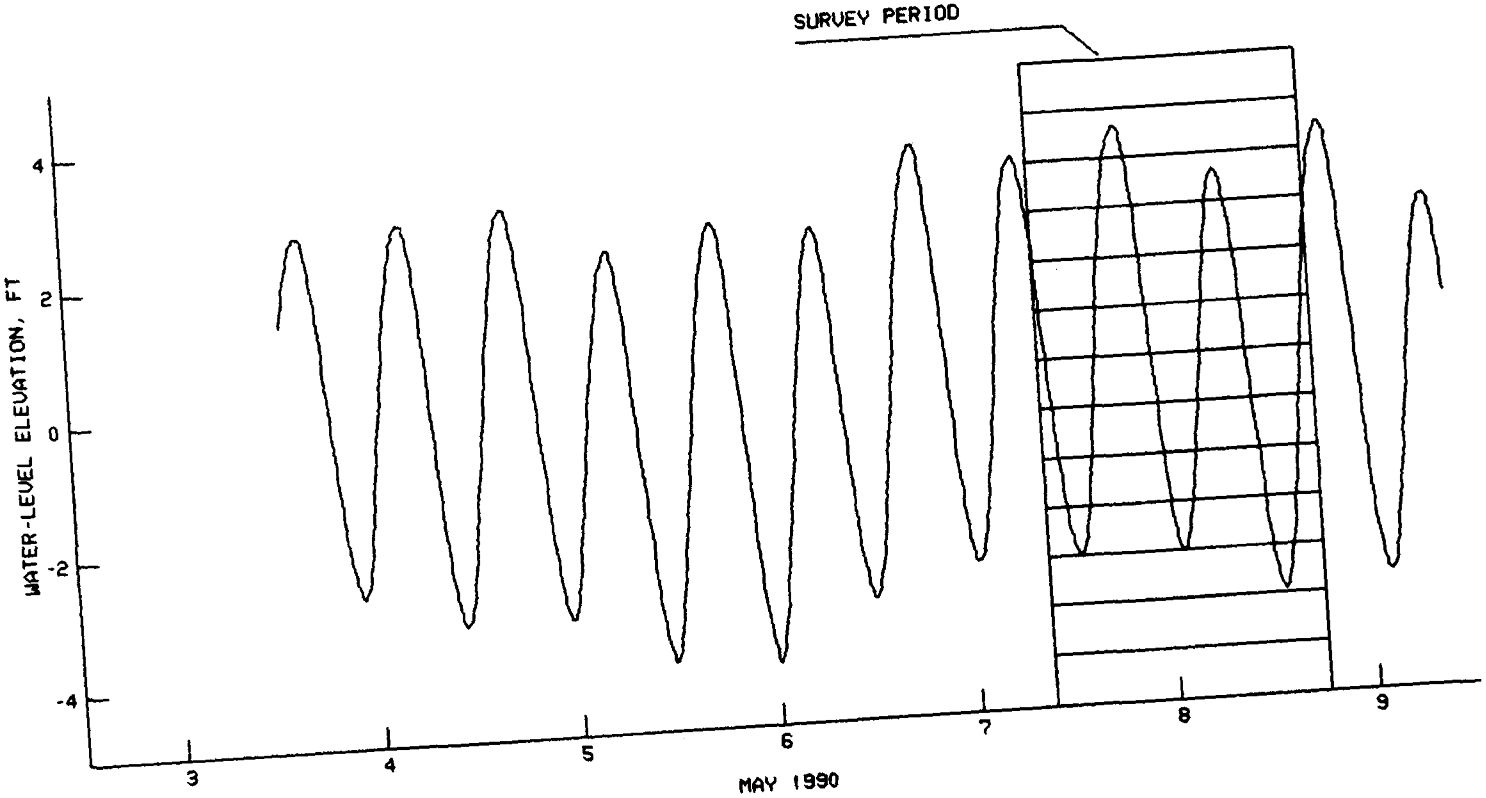

WATER-LEVEL ELEVATION*
AT STATION TLR-3
4 - 9 MAY 1990
SURVEY PERIOD
WATER-LEVEL ELEVATION, FT
4
2
0
-2
-4
4
5
6
7
8
9
10
MAY 1990
*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 3.16

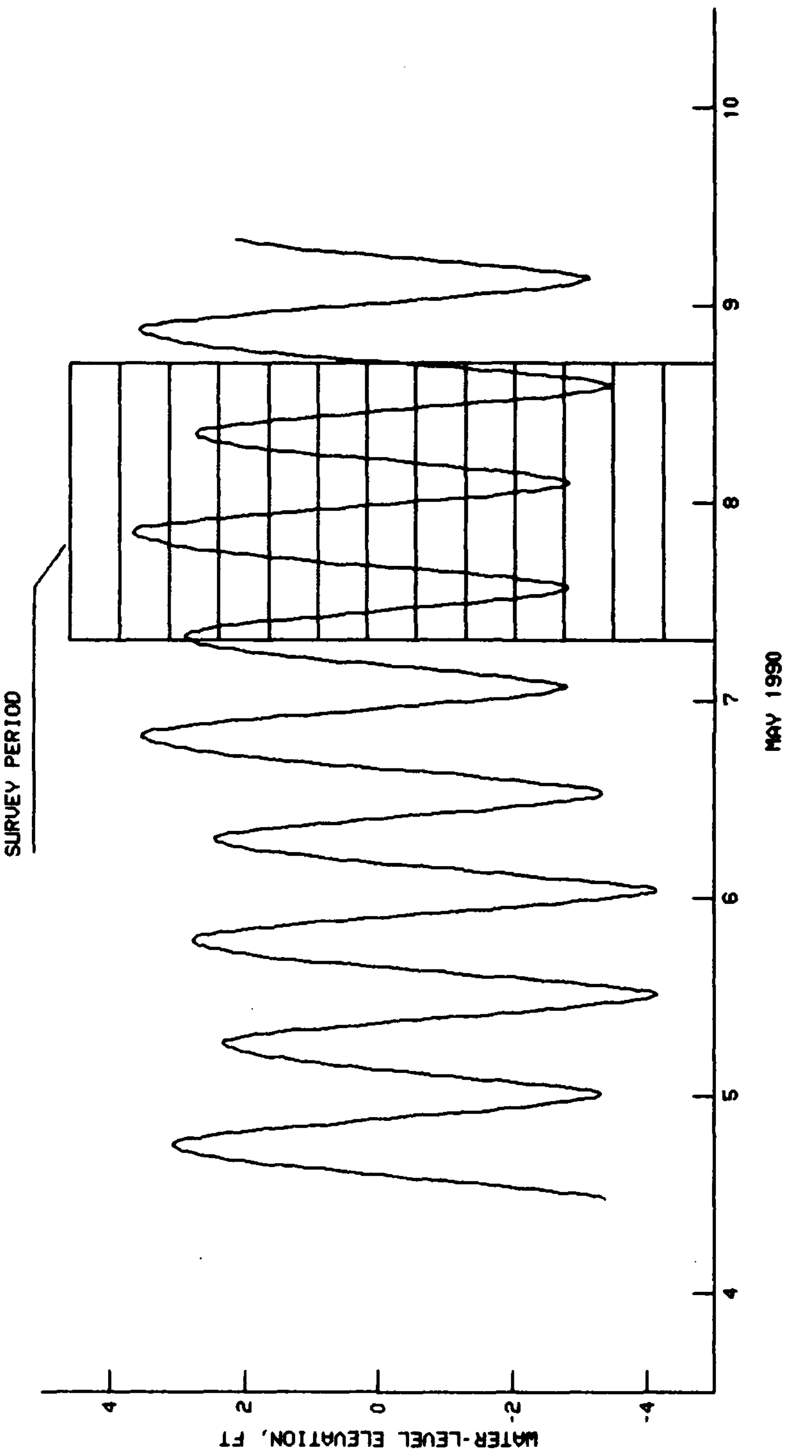
PLATE 4



*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 3.34

WATER-LEVEL ELEVATION*
AT STATION TLR-4
3 - 9 MAY 1990

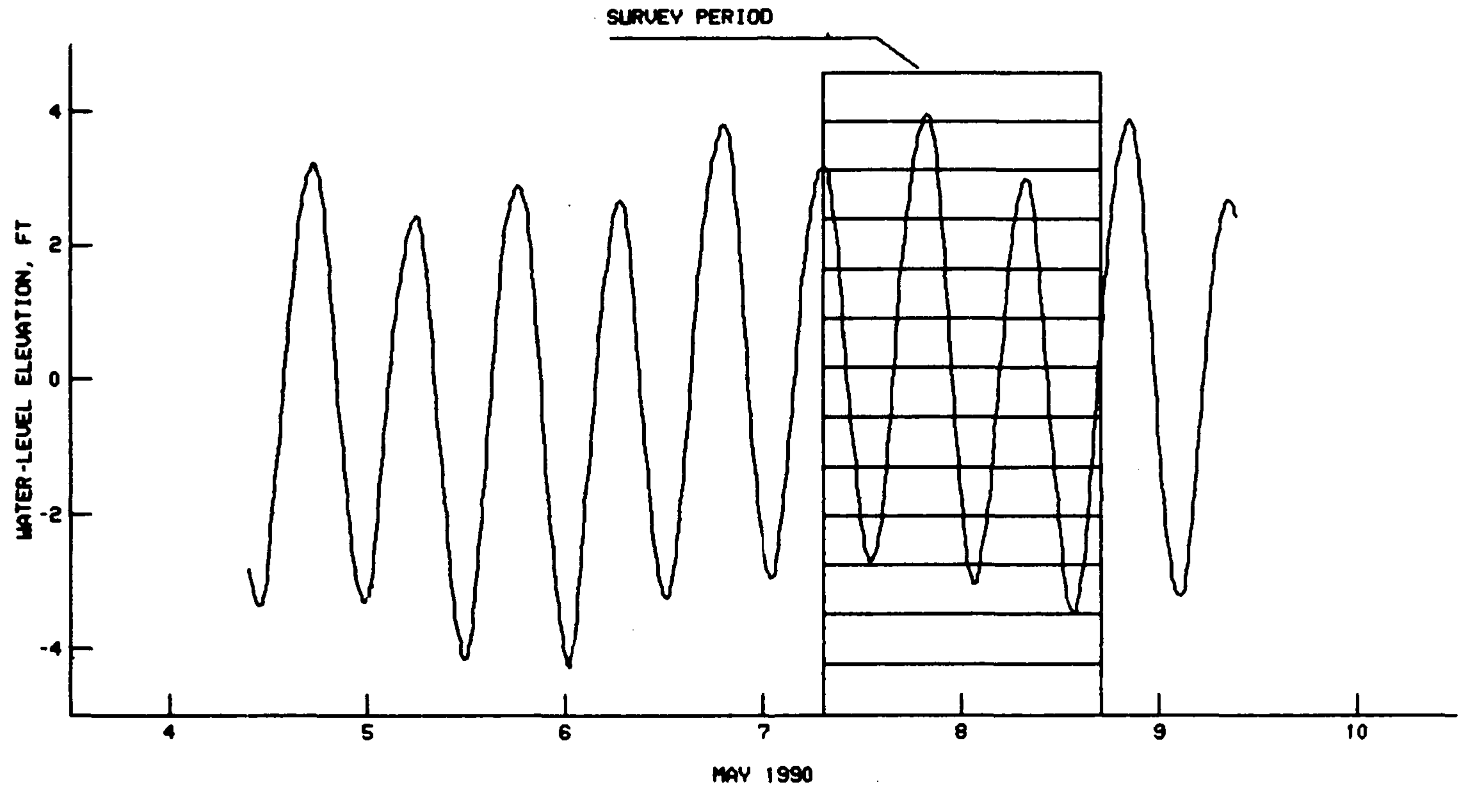
PLATE 5



WATER-LEVEL ELEVATION*
AT STATION TLR-5
4 - 9 MAY 1990

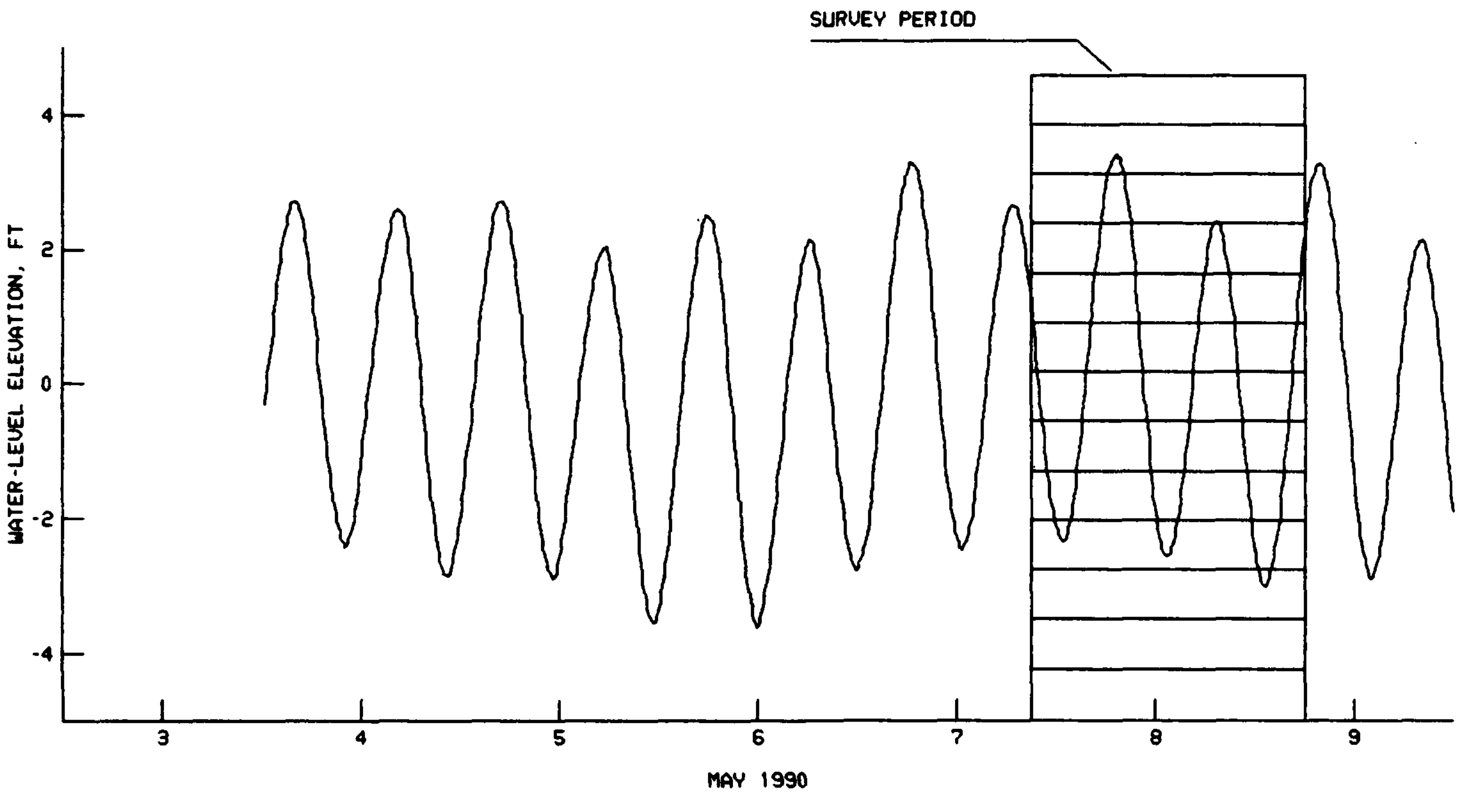
*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 1.47

PLATE 6



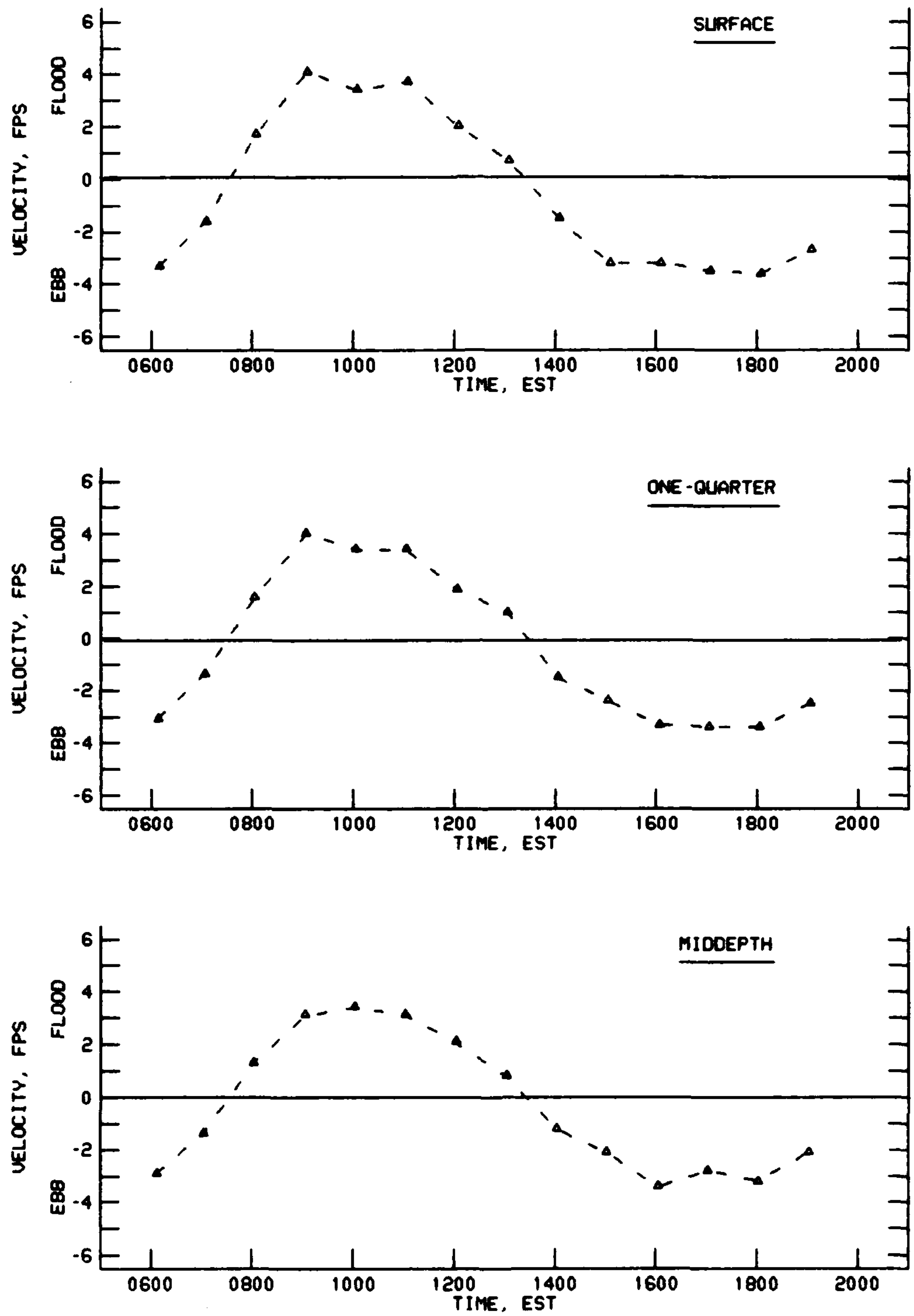
*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 3.87

WATER-LEVEL ELEVATION*
AT STATION TLR-6
4 - 9 MAY 1990



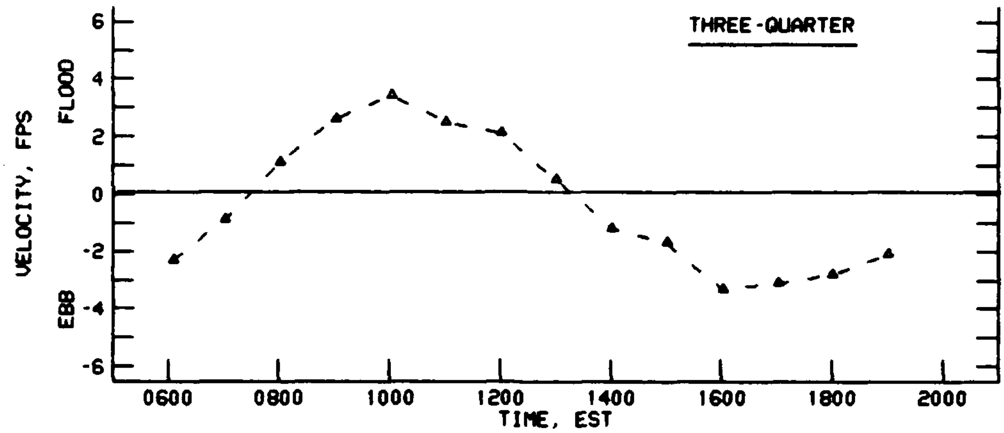
*MEAN LOW WATER-LEVEL ELEVATION USED AS DATUM = 3.63

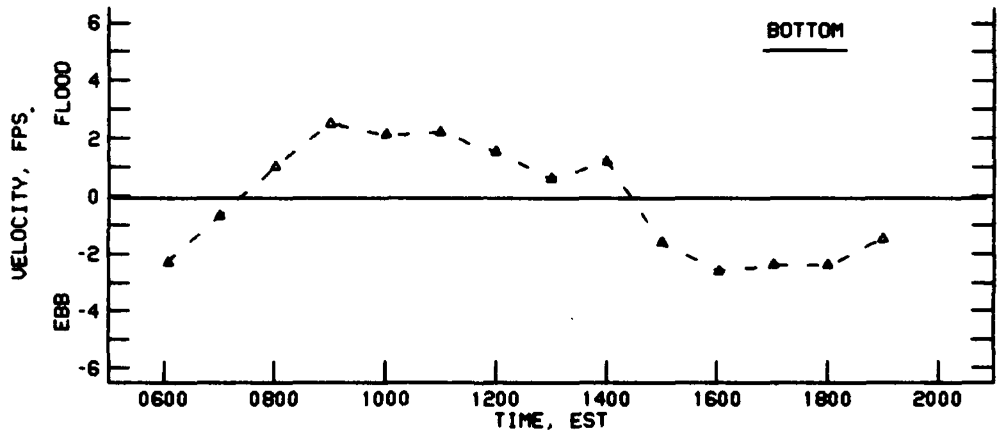
WATER-LEVEL ELEVATION*
AT STATION TLR-7
3 - 9 MAY 1990



VELOCITIES AT STATION 1A
7 MAY 1990

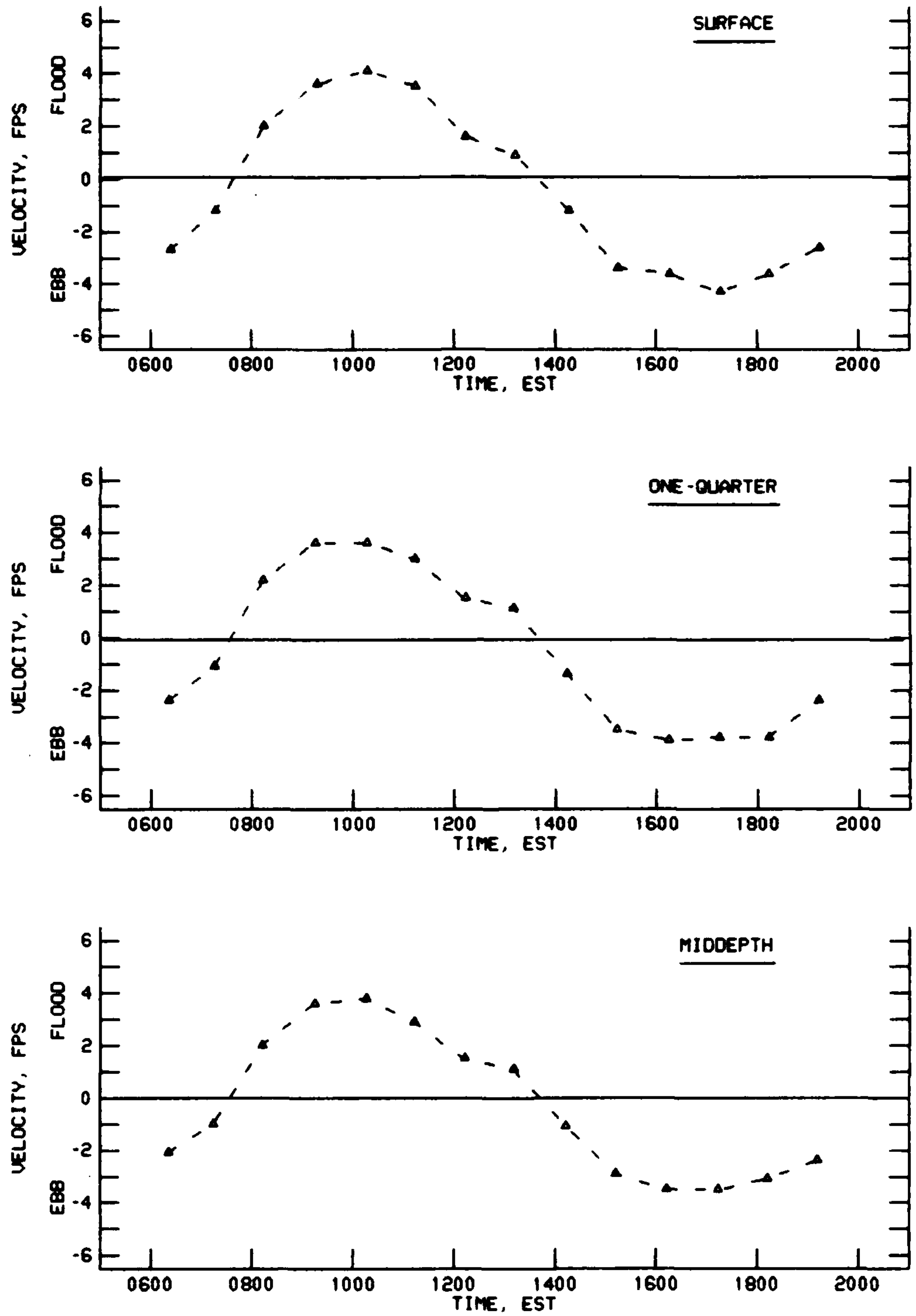
PLATE 9
(Sheet 1 of 2)



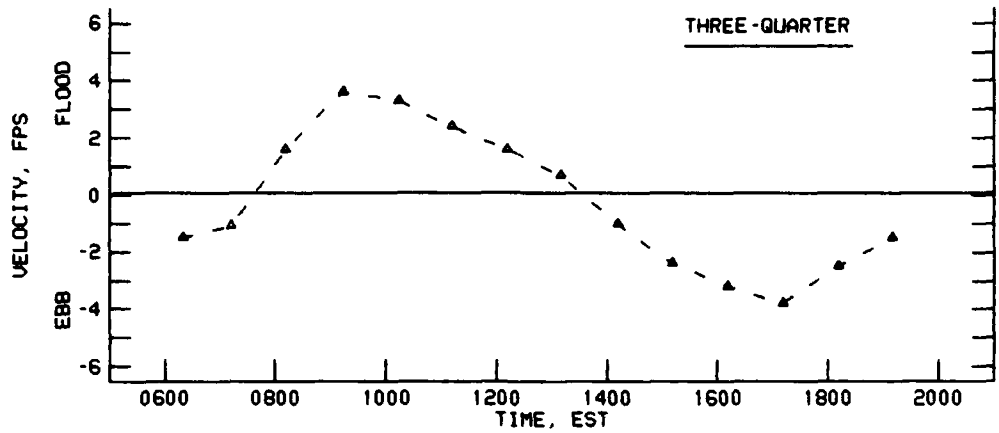


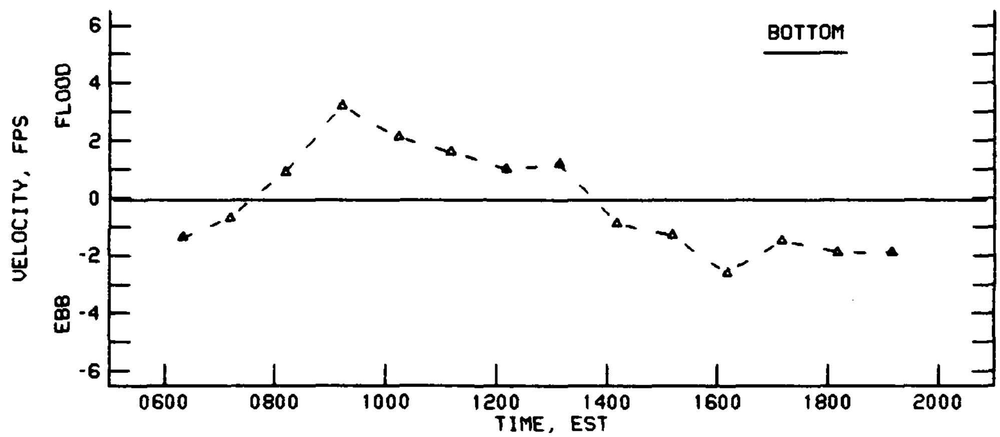
VELOCITIES AT STATION 1A
7 MAY 1990

PLATE 9
(Sheet 2 of 2)



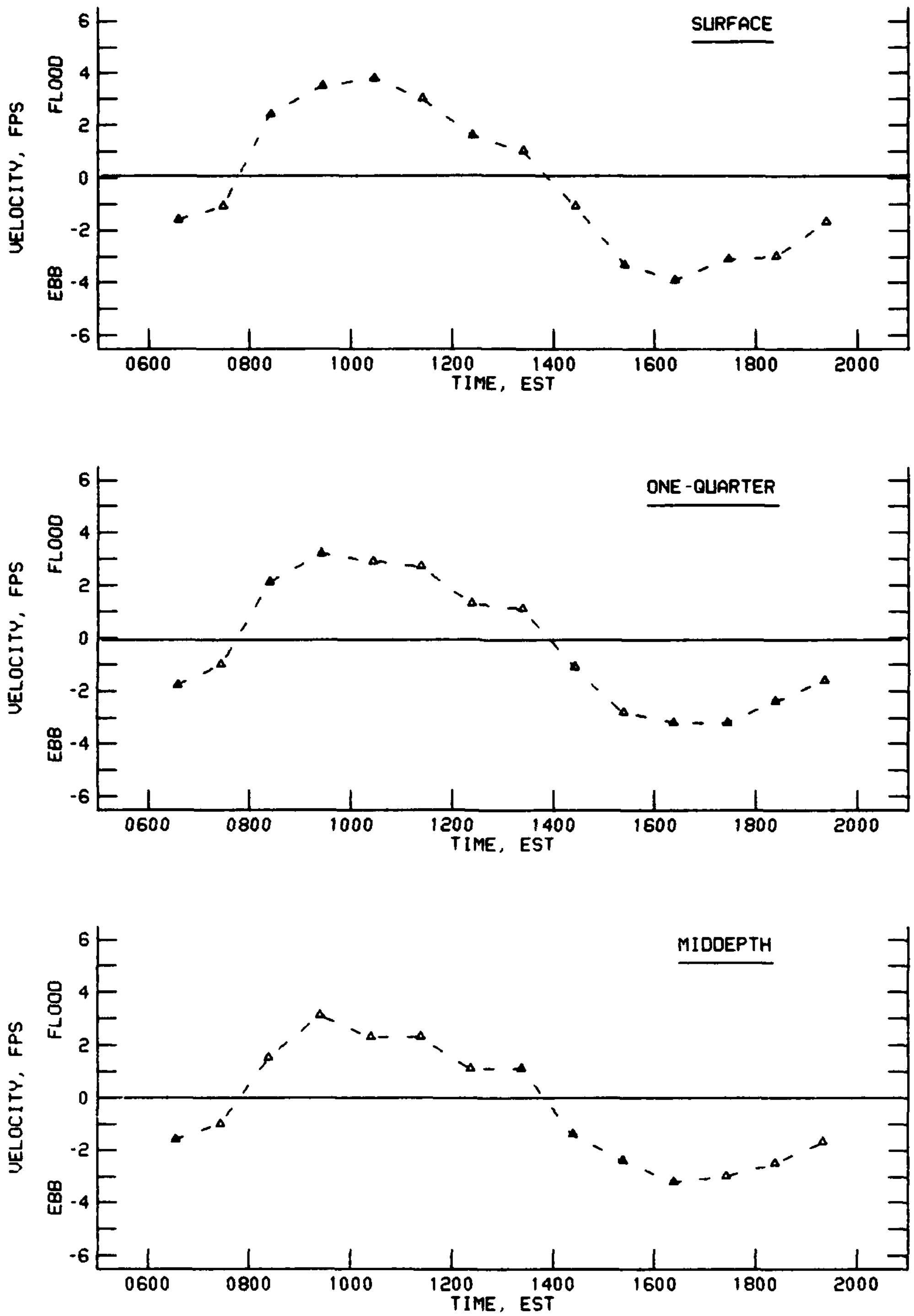
VELOCITIES AT STATION 1B
7 MAY 1990



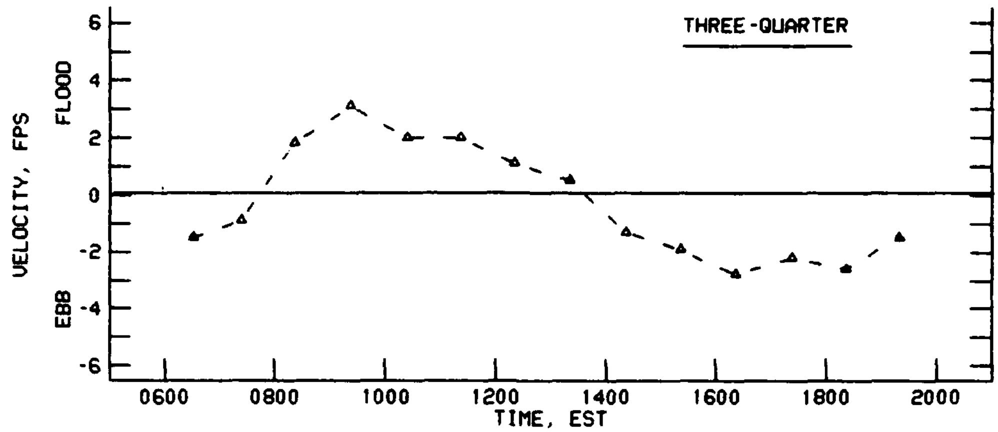


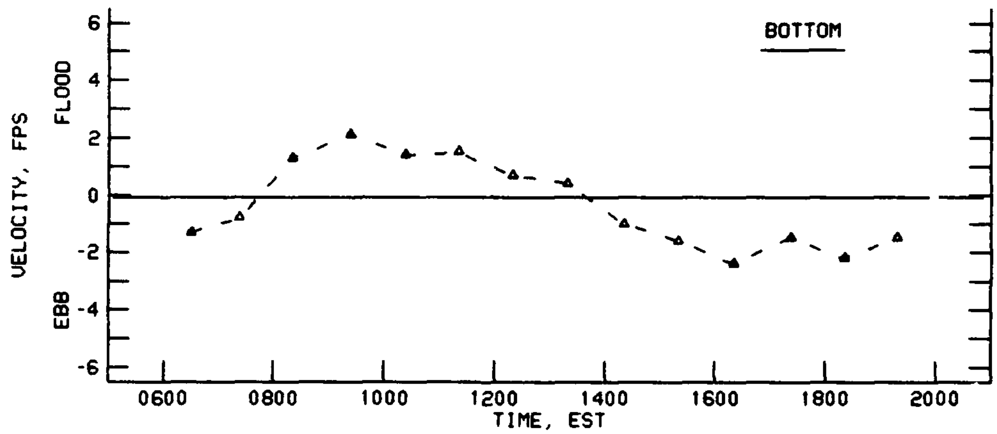
VELOCITIES AT STATION 1B
7 MAY 1990

PLATE 10
(Sheet 2 of 2)



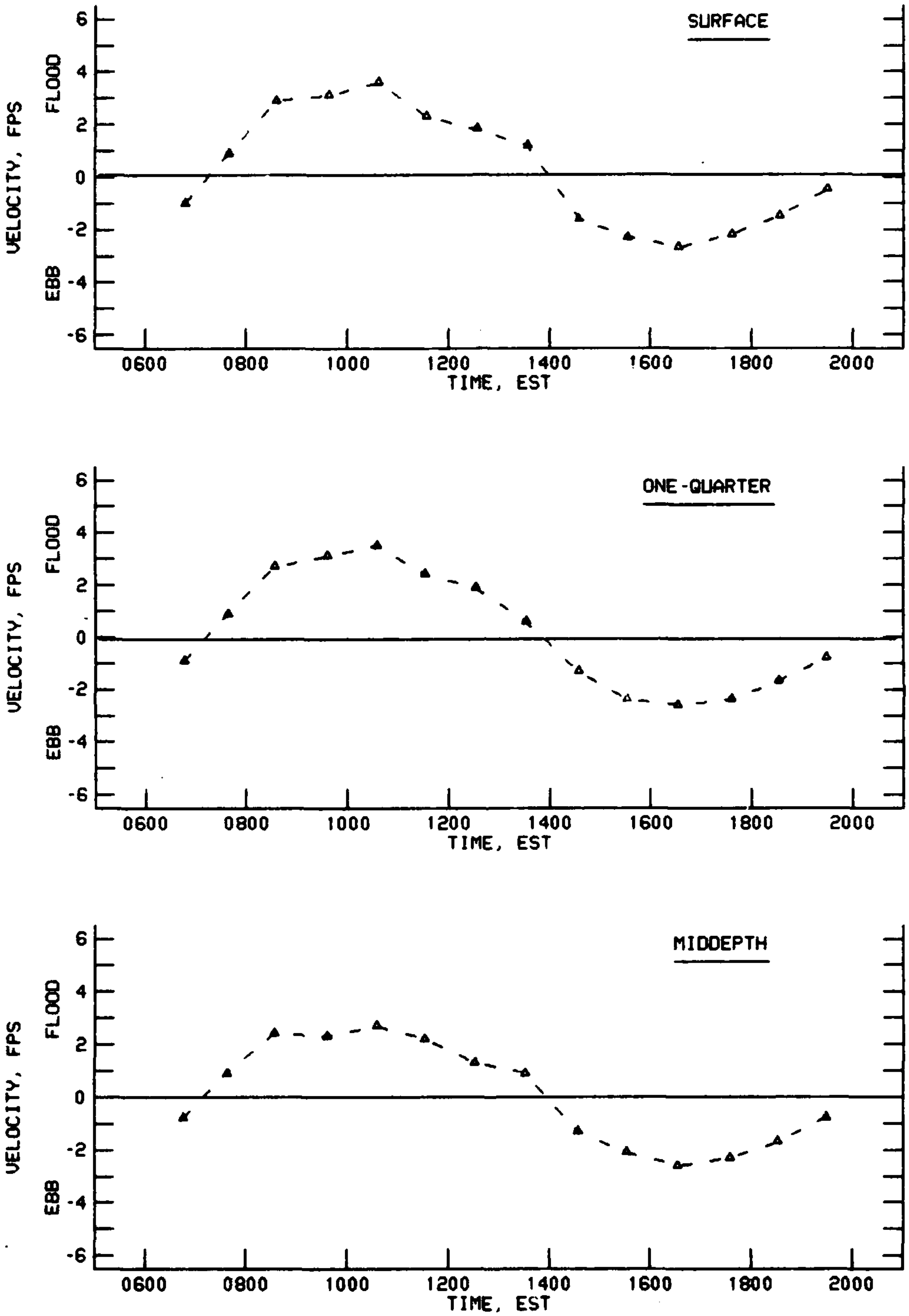
VELOCITIES AT STATION 1C
7 MAY 1990



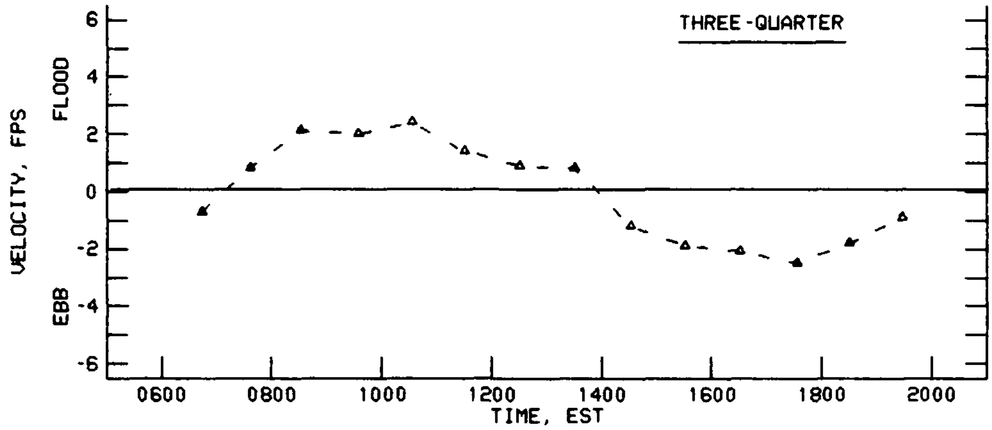


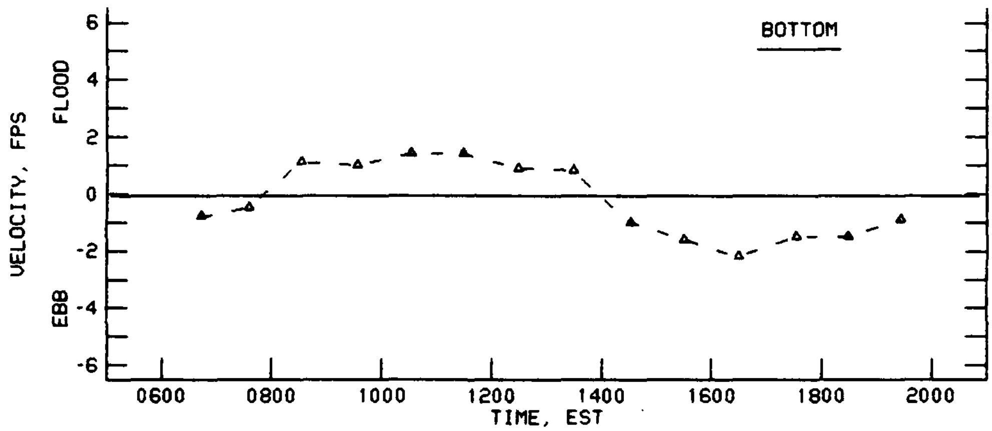
VELOCITIES AT STATION 1C
7 MAY 1990

PLATE 11
(Sheet 2 of 2)



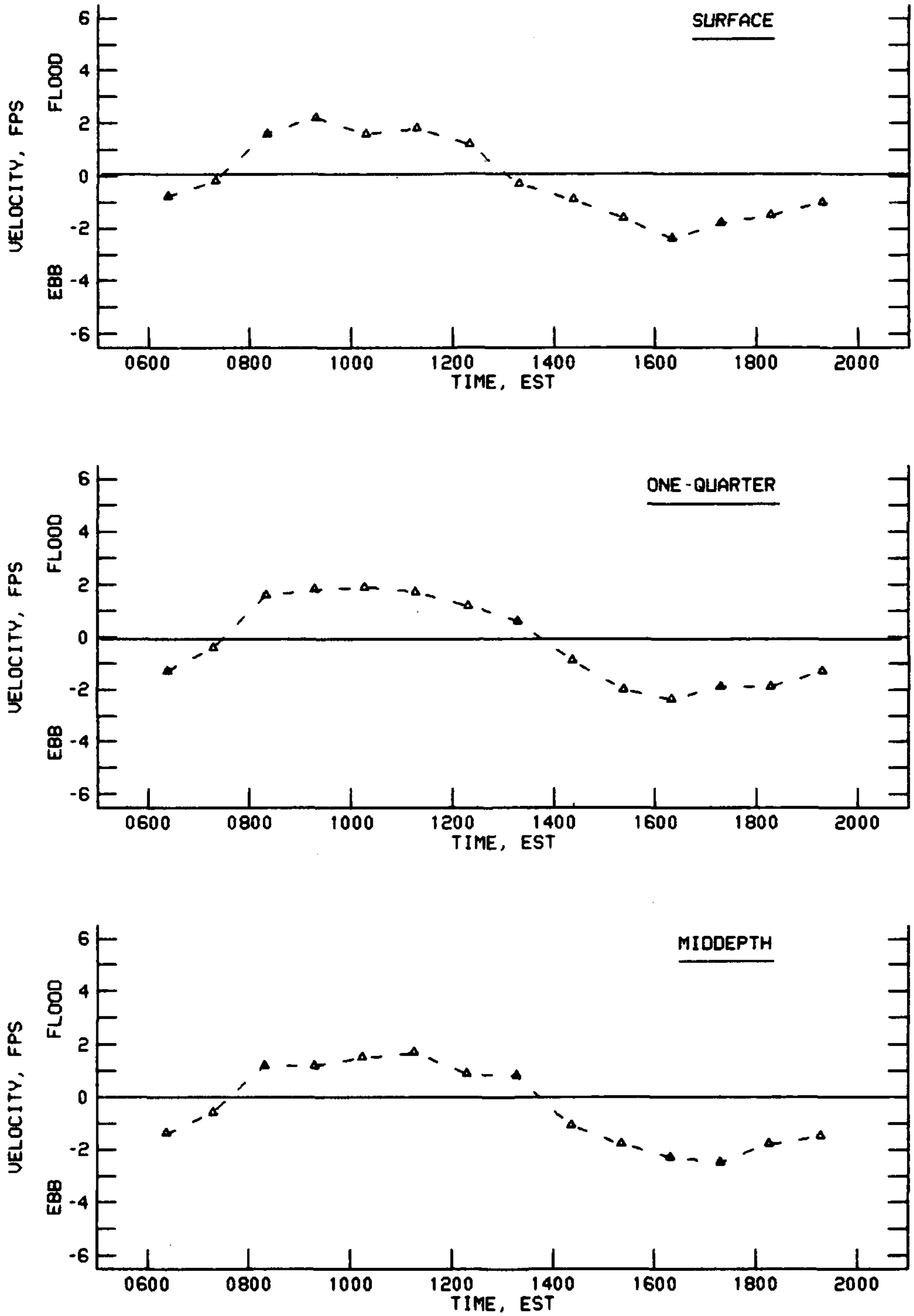
VELOCITIES AT STATION 1D
7 MAY 1990





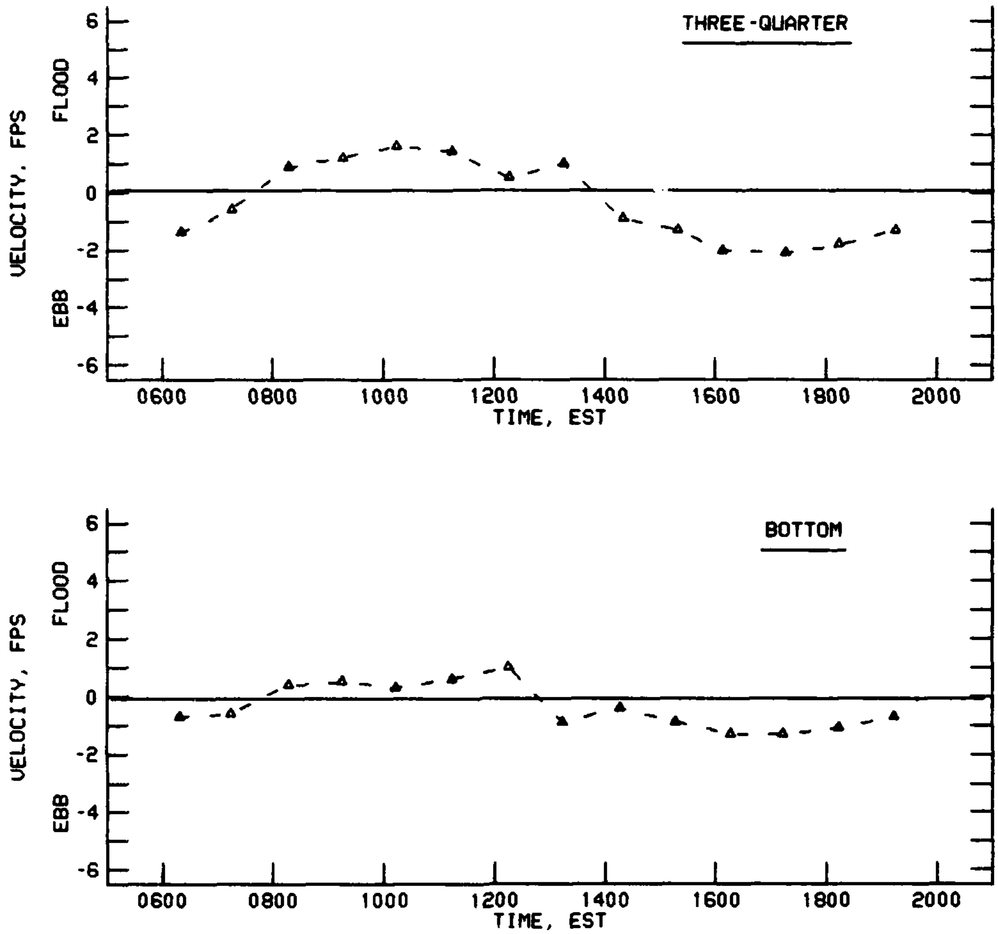
VELOCITIES AT STATION 1D
7 MAY 1990

PLATE 12
(Sheet 2 of 2)



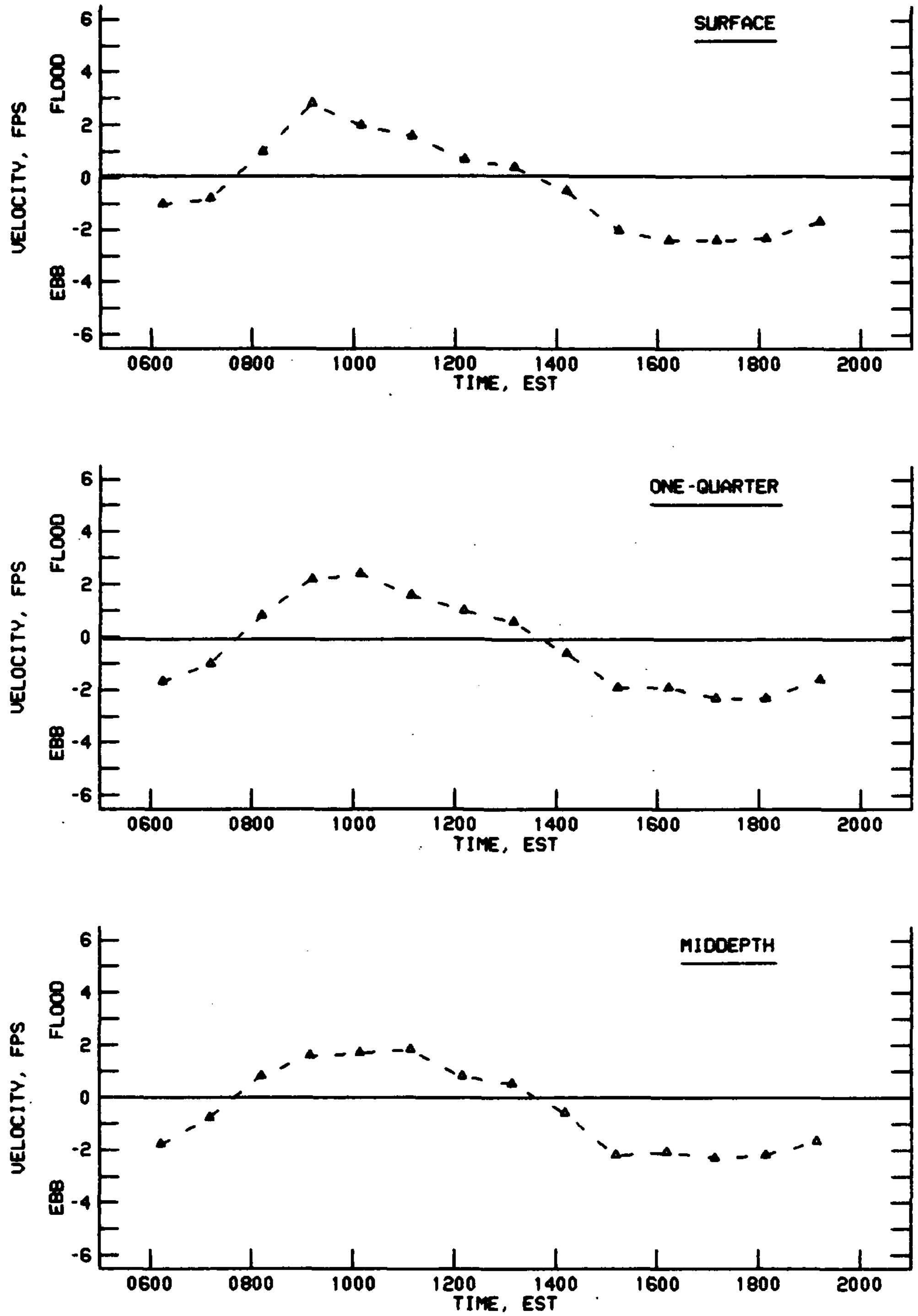
VELOCITIES AT STATION 2A
7 MAY 1990

PLATE 13
(Sheet 1 of 2)

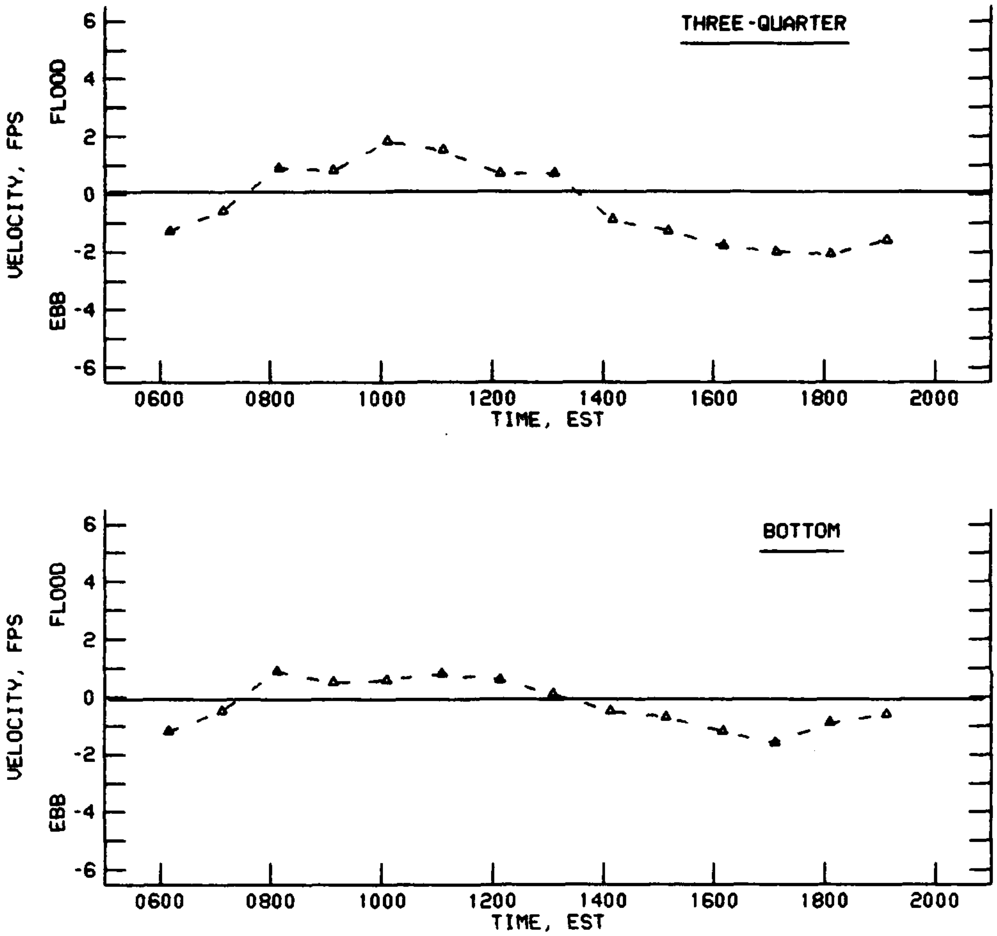


VELOCITIES AT STATION 2A
7 MAY 1990

PLATE 13
(Sheet 2 of 2)

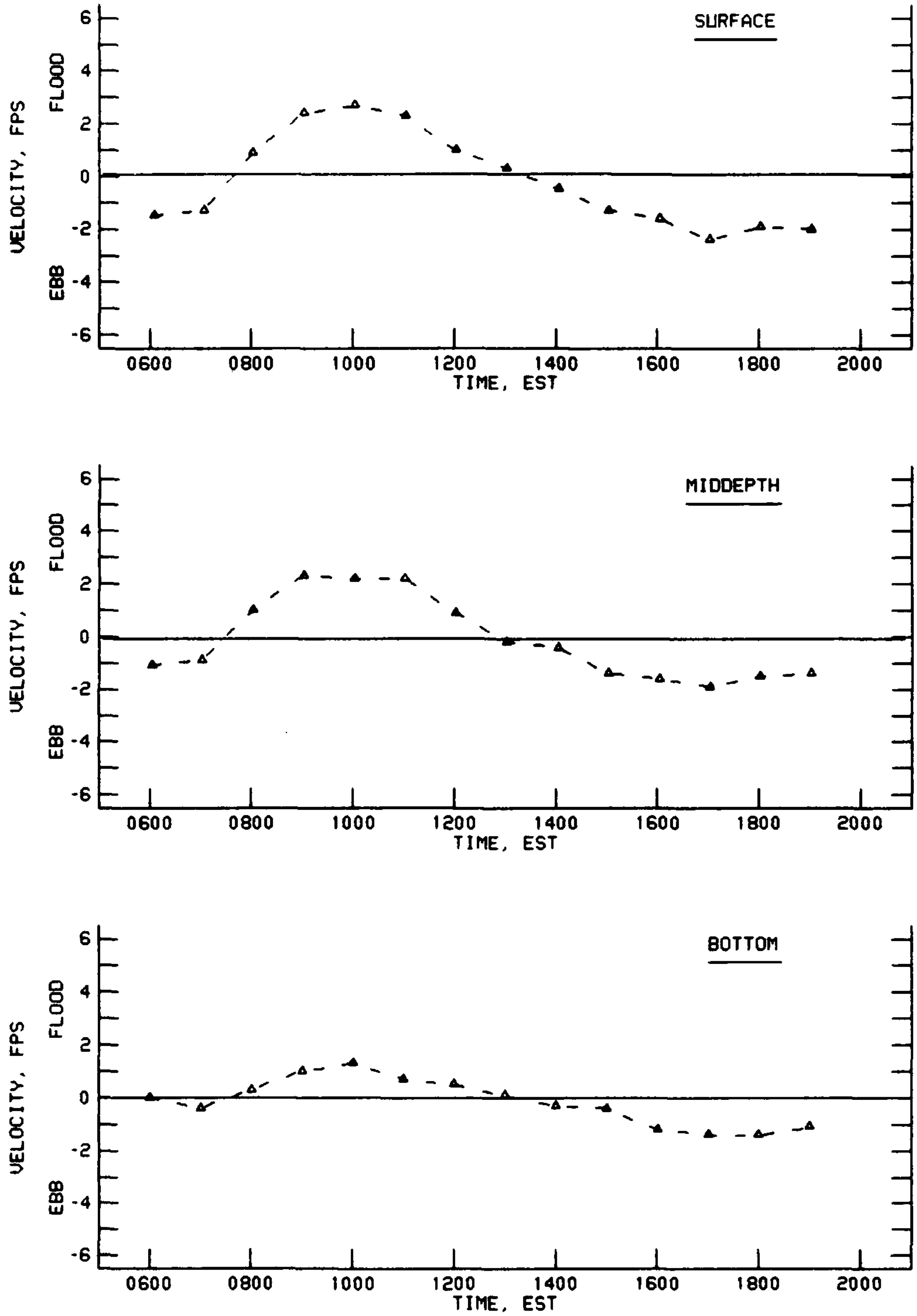


VELOCITIES AT STATION 2B
7 MAY 1990

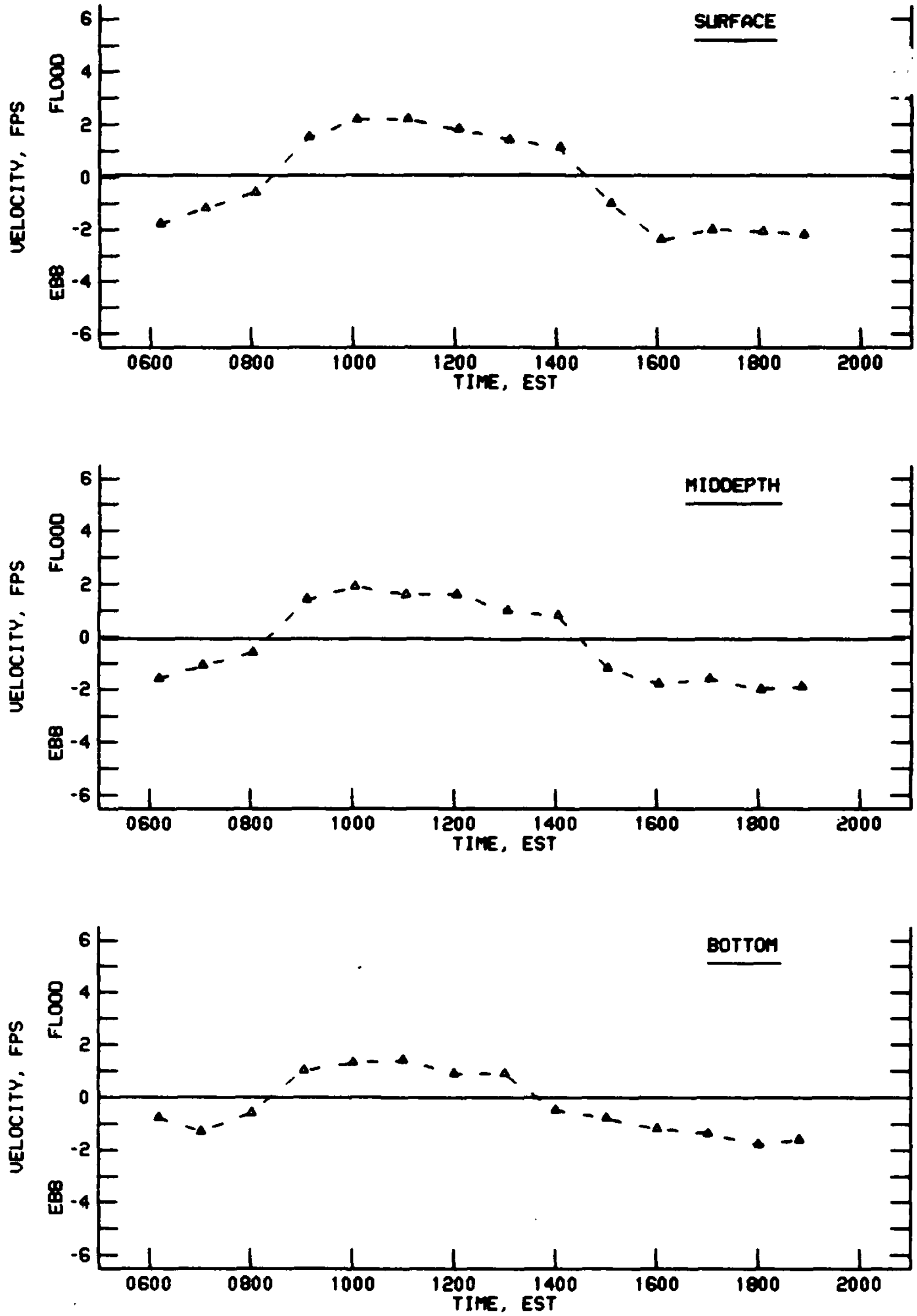


VELOCITIES AT STATION 2B
7 MAY 1990

PLATE 14
(Sheet 2 of 2)

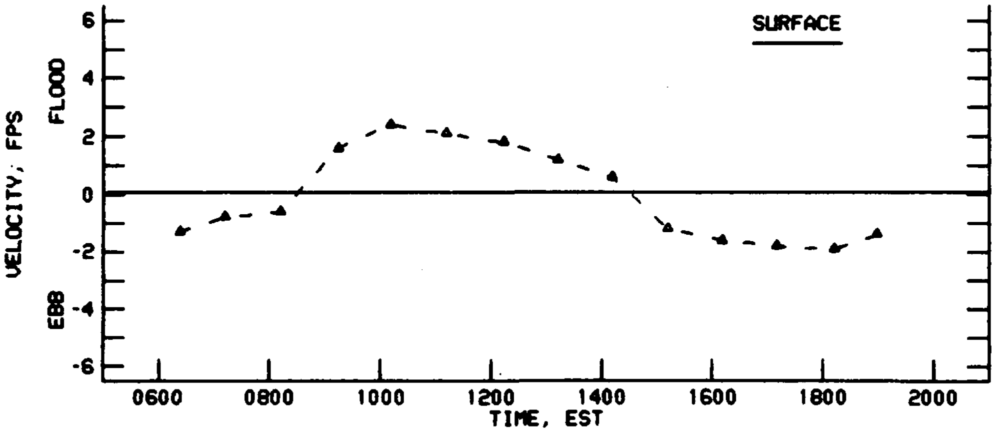


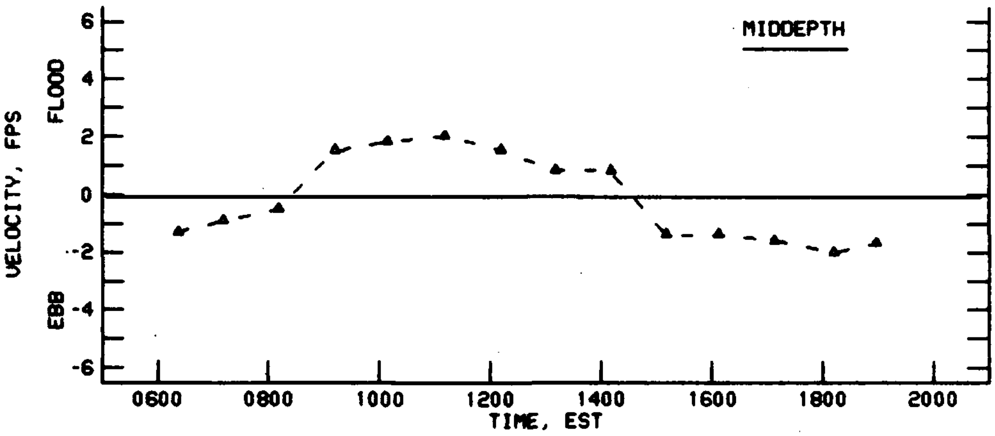
VELOCITIES AT STATION 2C
7 MAY 1990

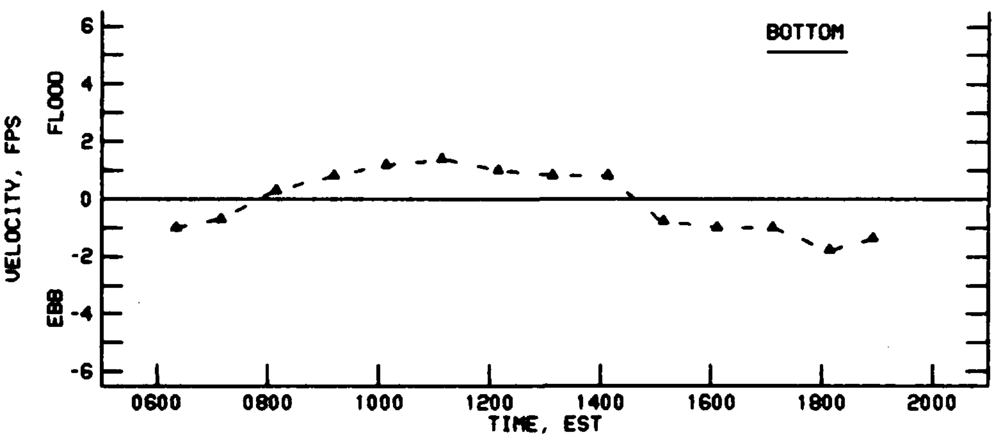


VELOCITIES AT STATION 3A
7 MAY 1990

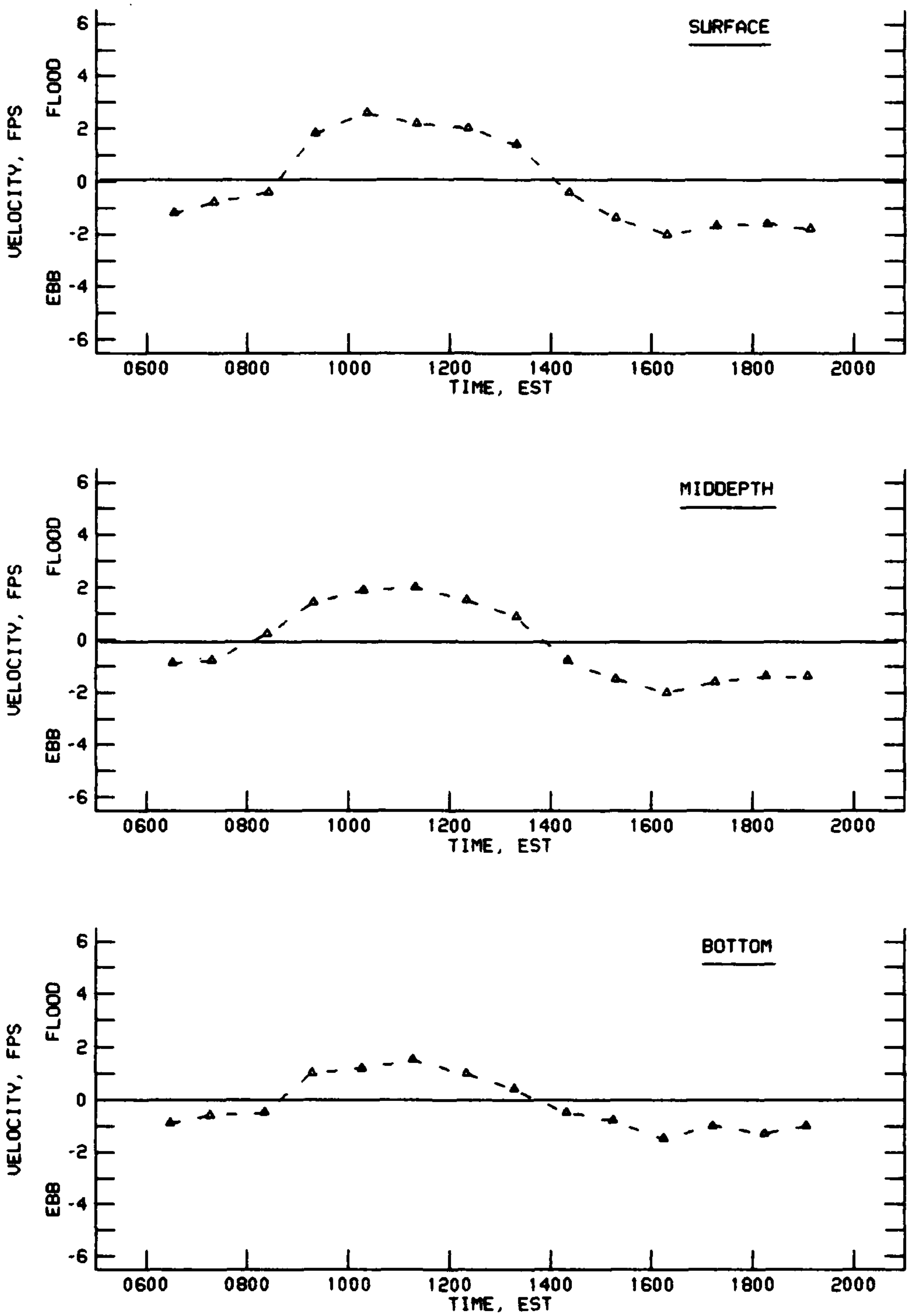
PLATE 16





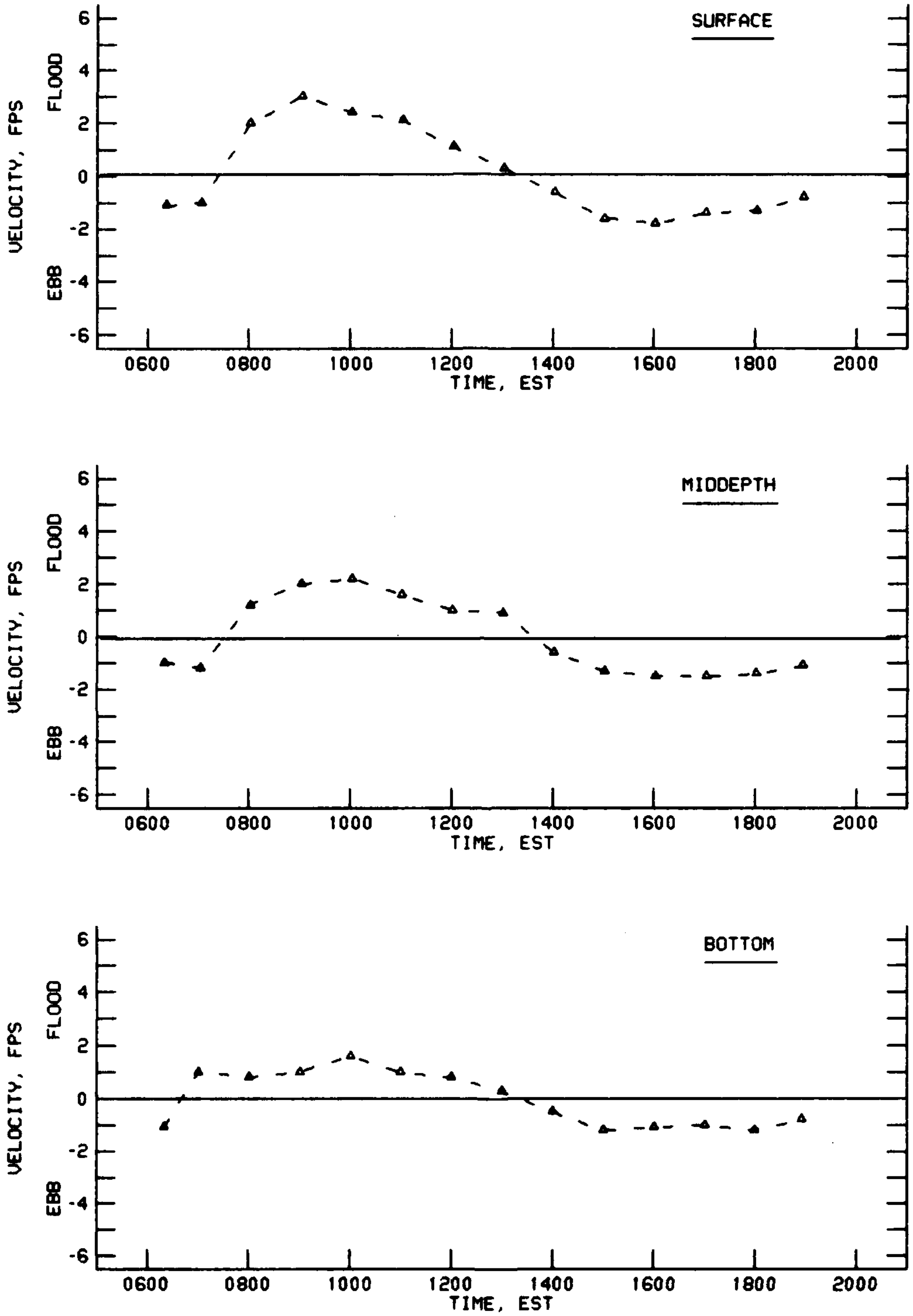


VELOCITIES AT STATION 3B
7 MAY 1990

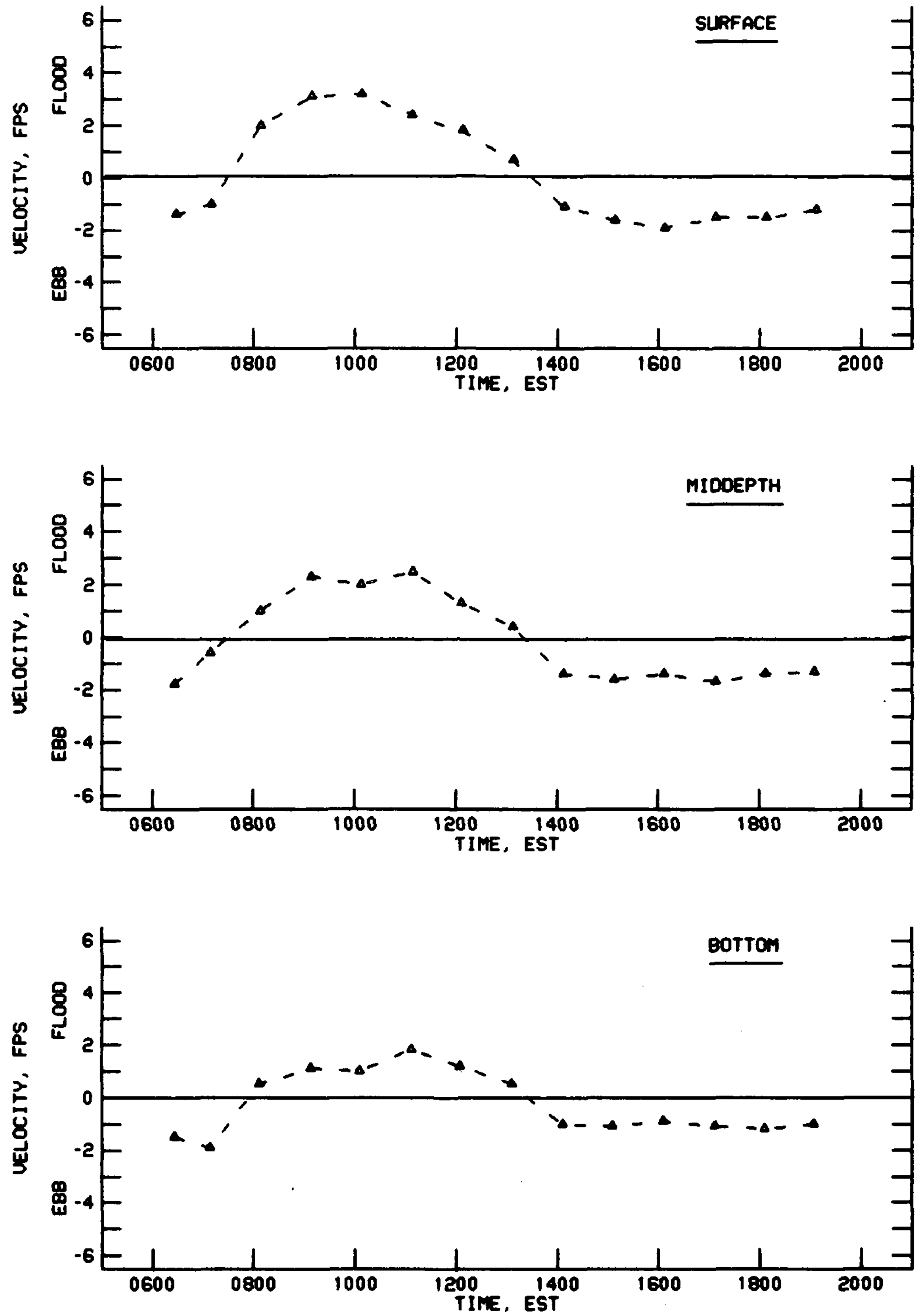


VELOCITIES AT STATION 3C
7 MAY 1990

PLATE 18

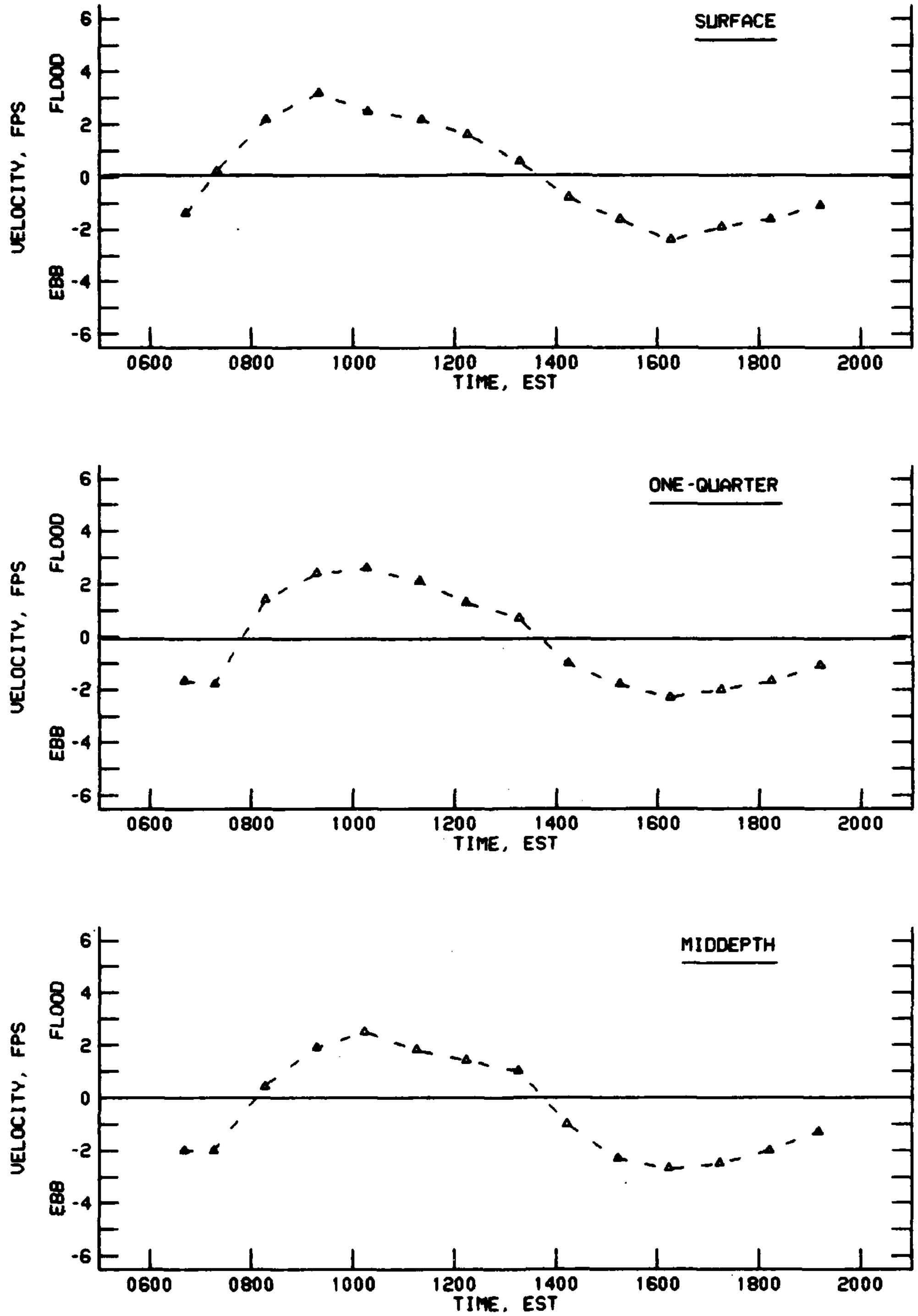


VELOCITIES AT STATION 4A
7 MAY 1990



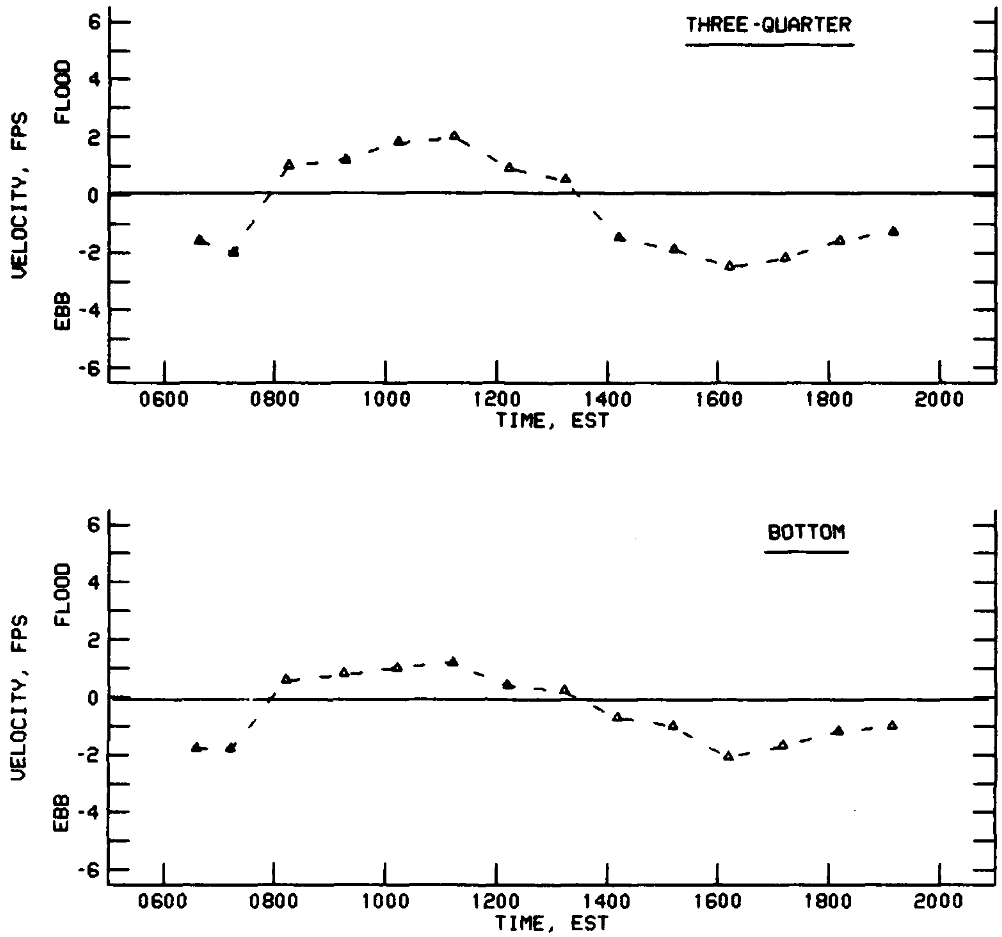
VELOCITIES AT STATION 4B
7 MAY 1990

PLATE 20



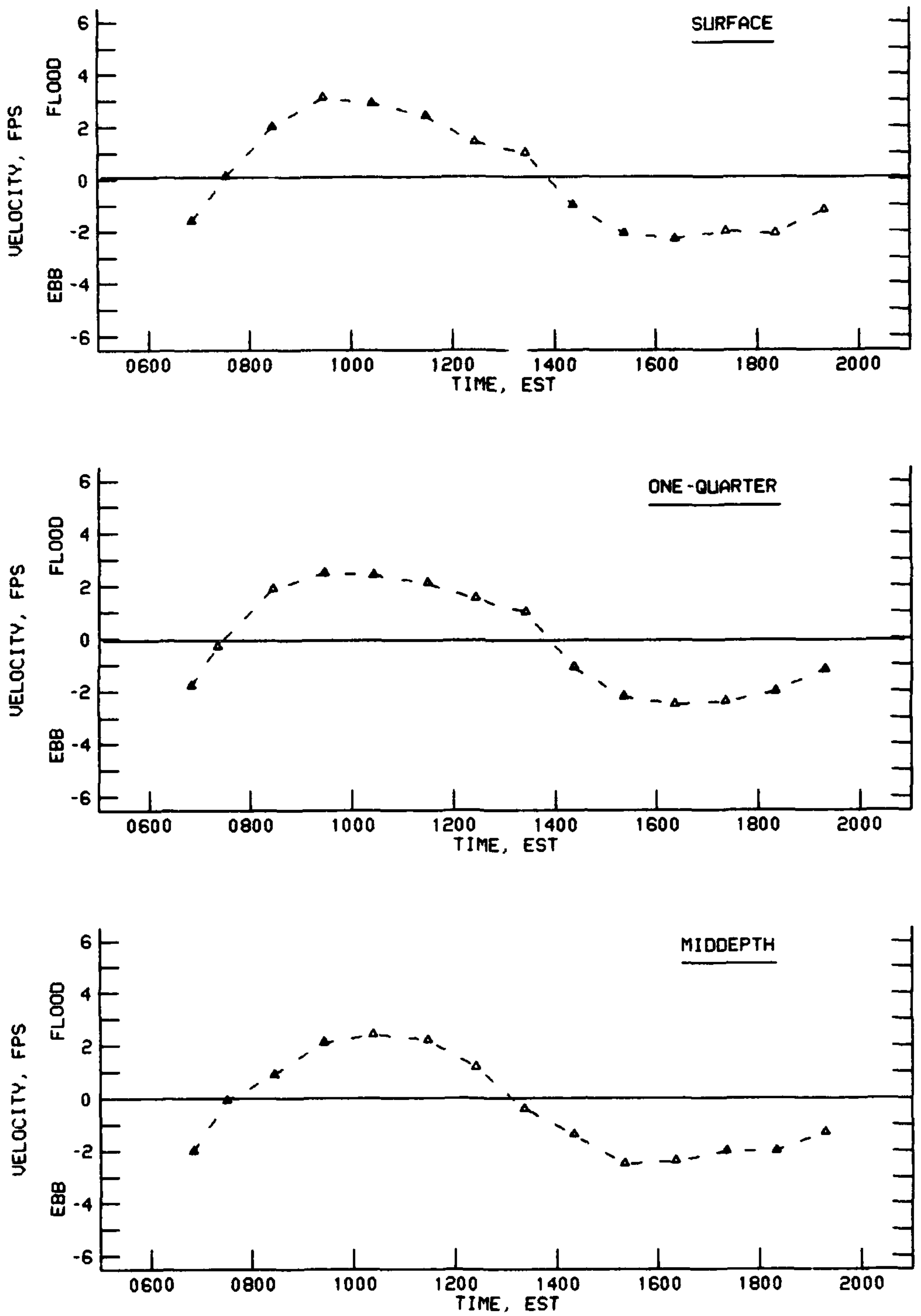
VELOCITIES AT STATION 4C
7 MAY 1990

PLATE 21
(Sheet 1 of 2)

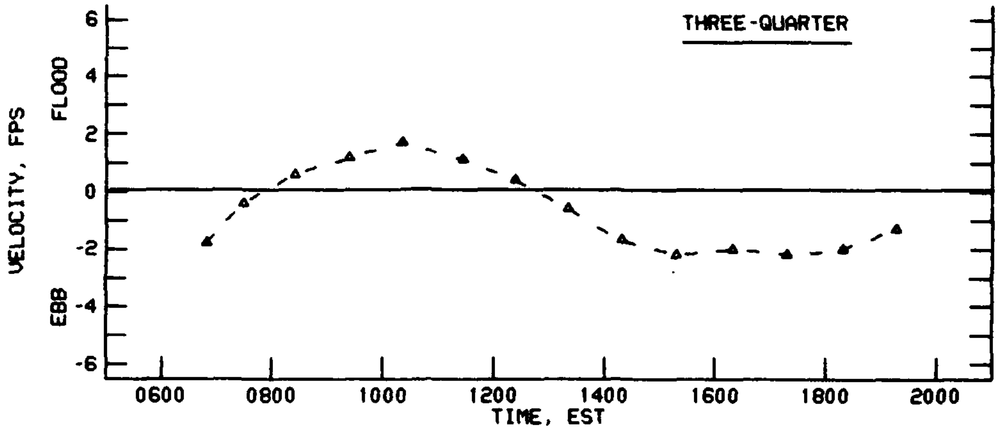


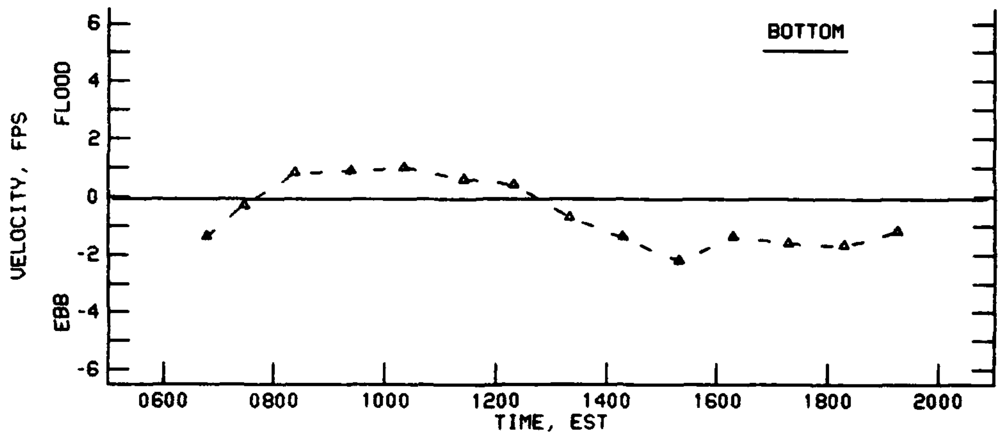
VELOCITIES AT STATION 4C
7 MAY 1990

PLATE 21
(Sheet 2 of 2)



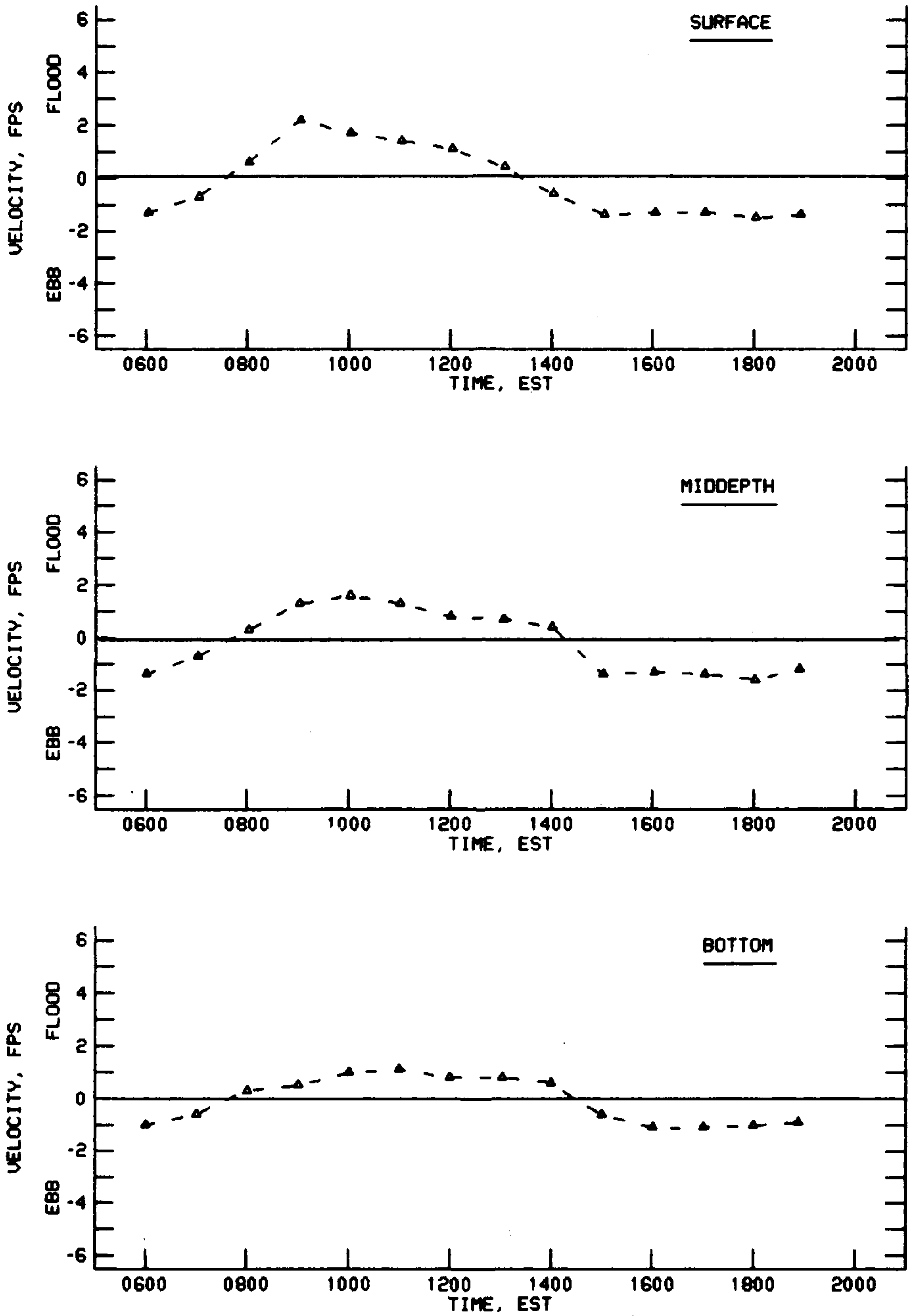
VELOCITIES AT STATION 4D
7 MAY 1990



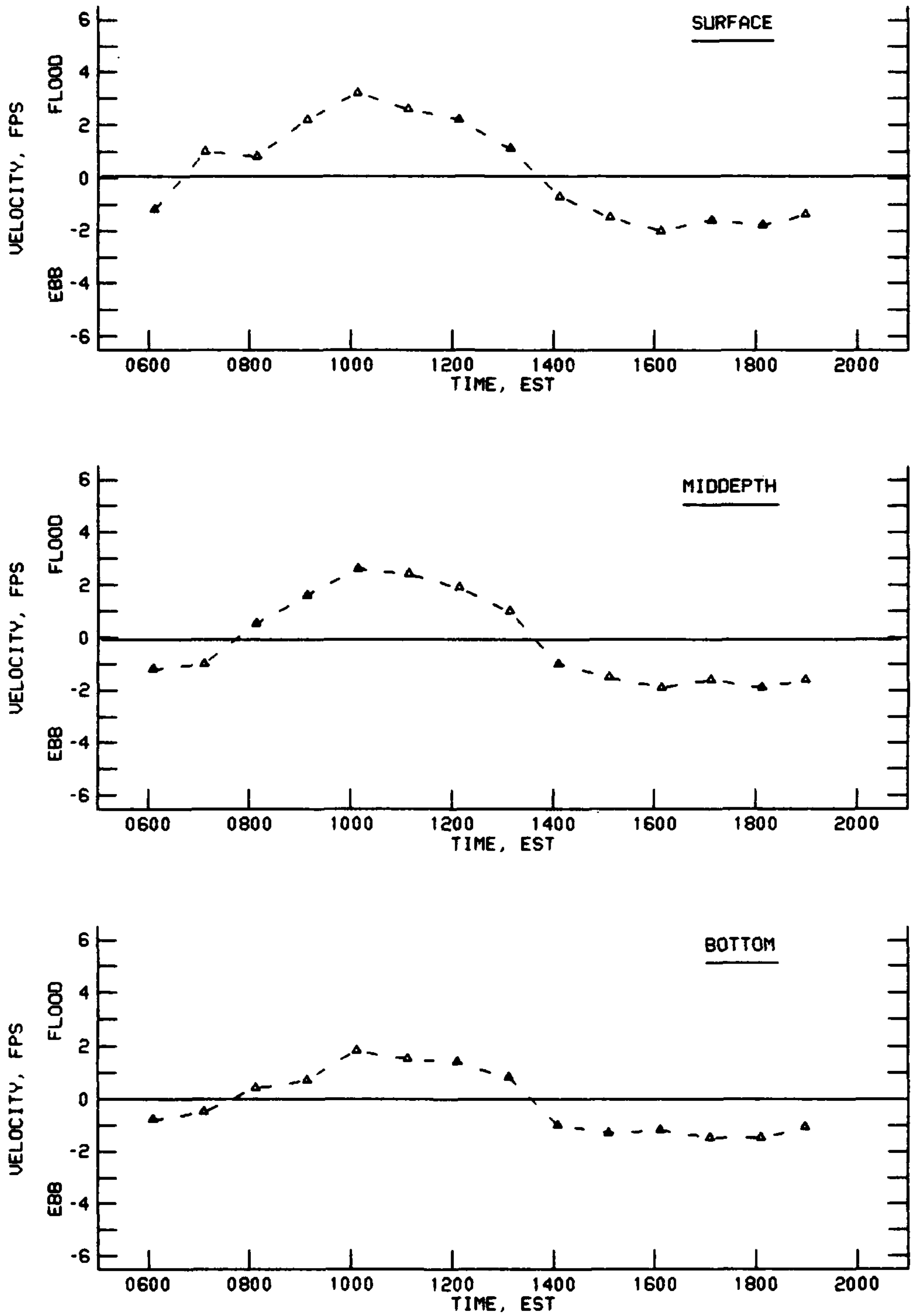


VELOCITIES AT STATION 4D
7 MAY 1990

PLATE 22
(Sheet 2 of 2)

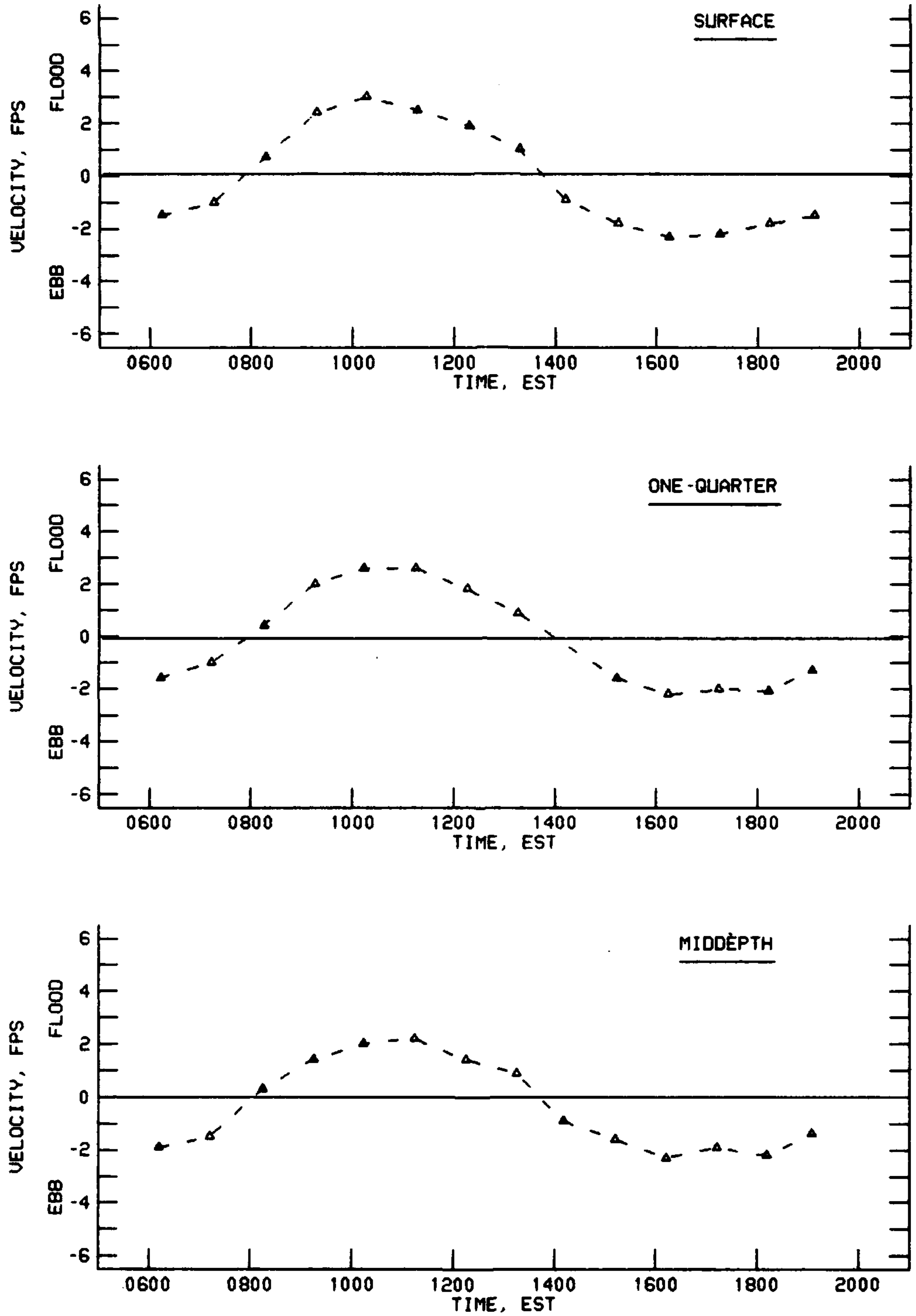


VELOCITIES AT STATION 4A
8 MAY 1990



VELOCITIES AT STATION 4B
8 MAY 1990

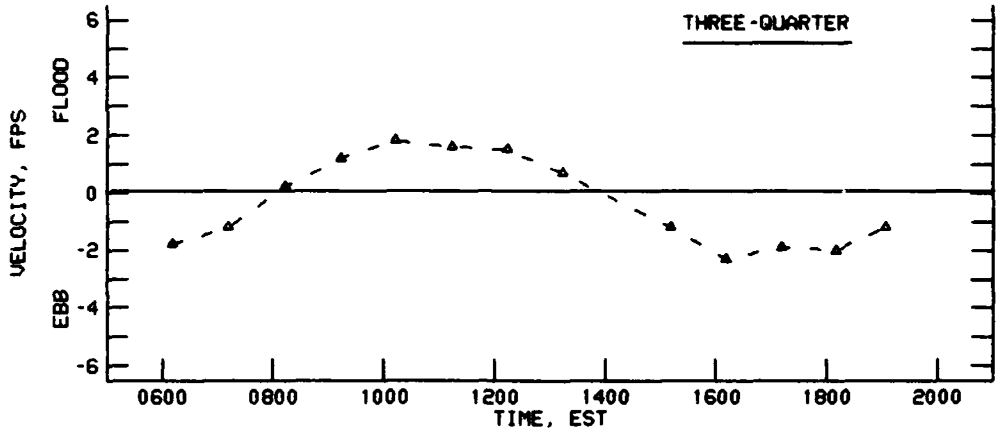
PLATE 24

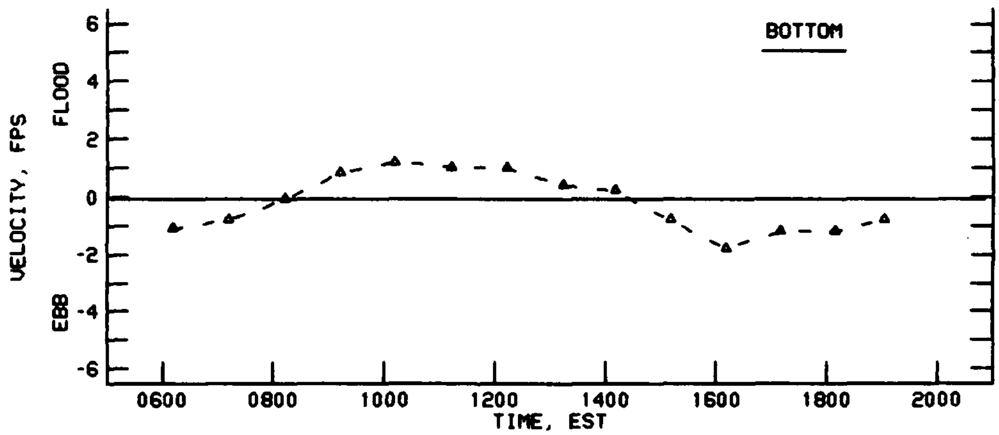


VELOCITIES AT STATION 4C

8 MAY 1990

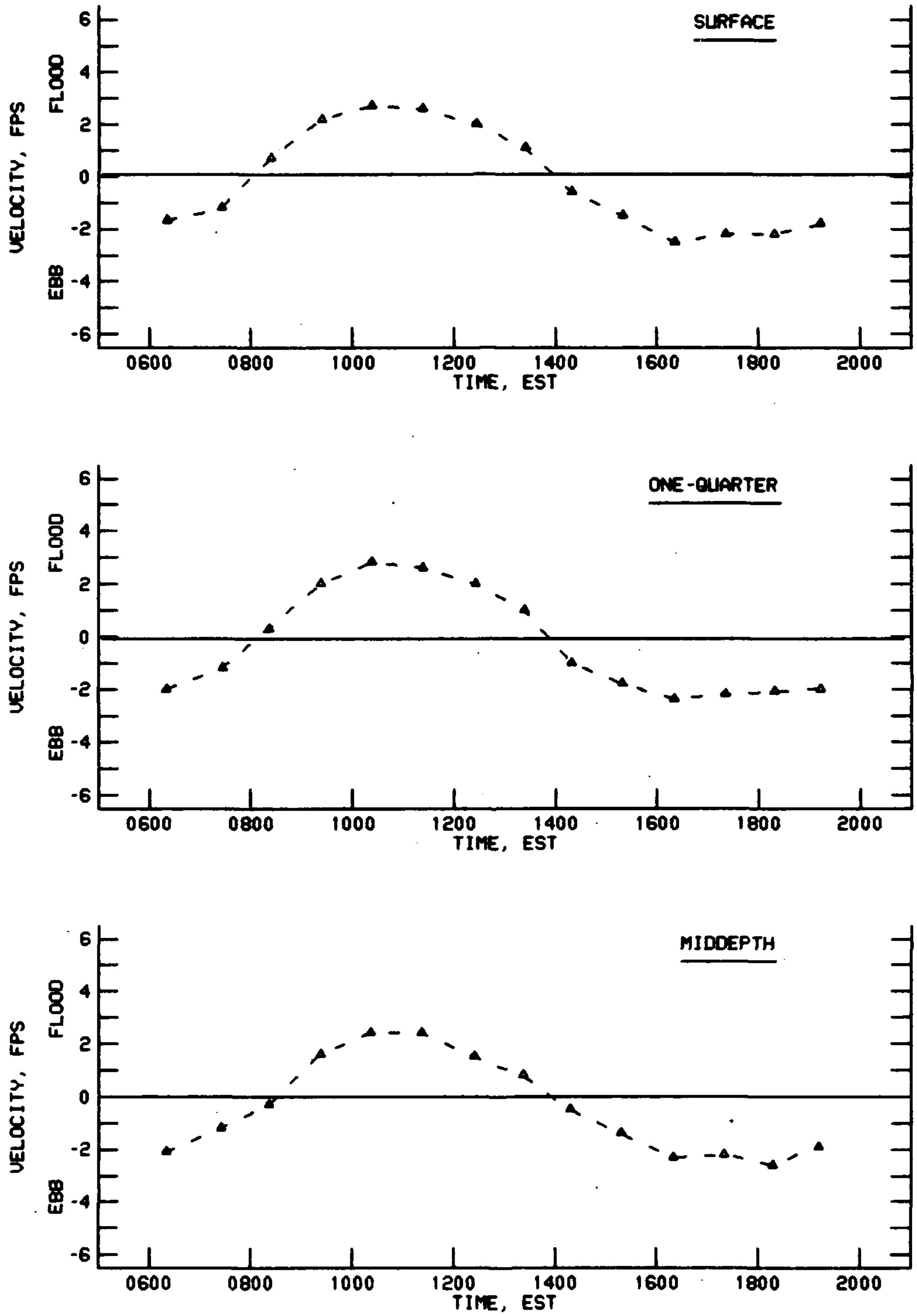
PLATE 25
(Sheet 1 of 2)





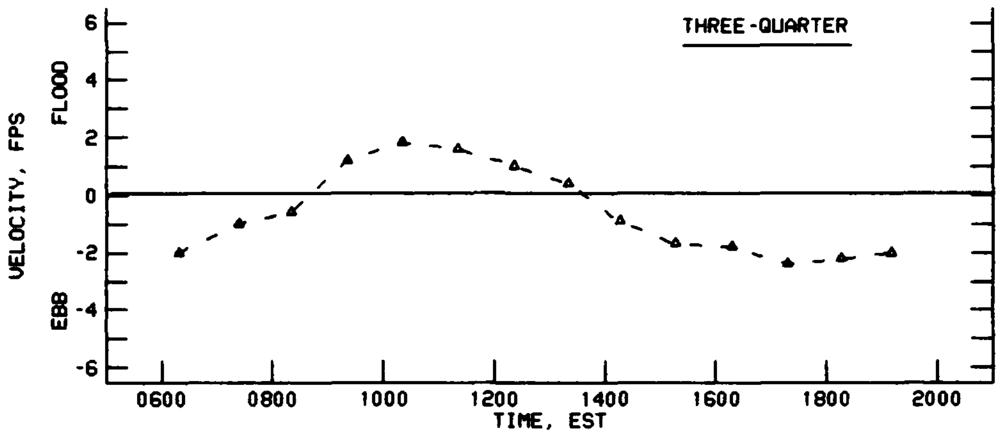
VELOCITIES AT STATION 4C
8 MAY 1990

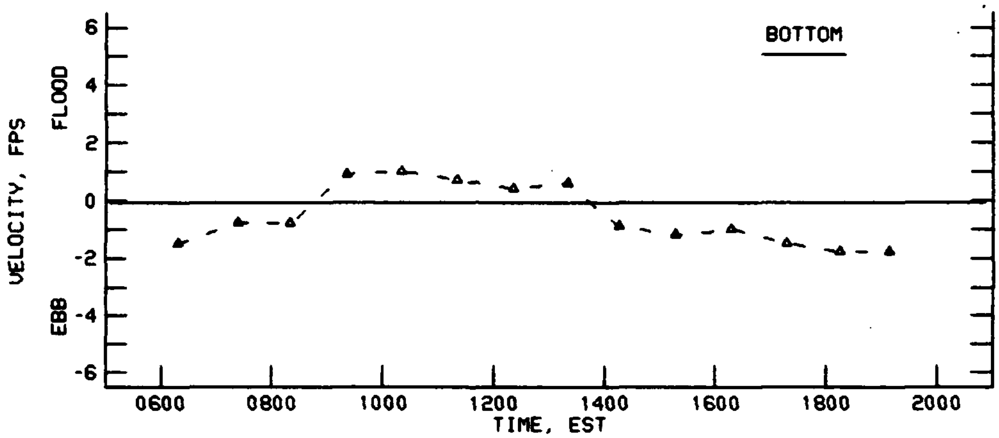
PLATE 25
(Sheet 2 of 2)



VELOCITIES AT STATION 4D
8 MAY 1990

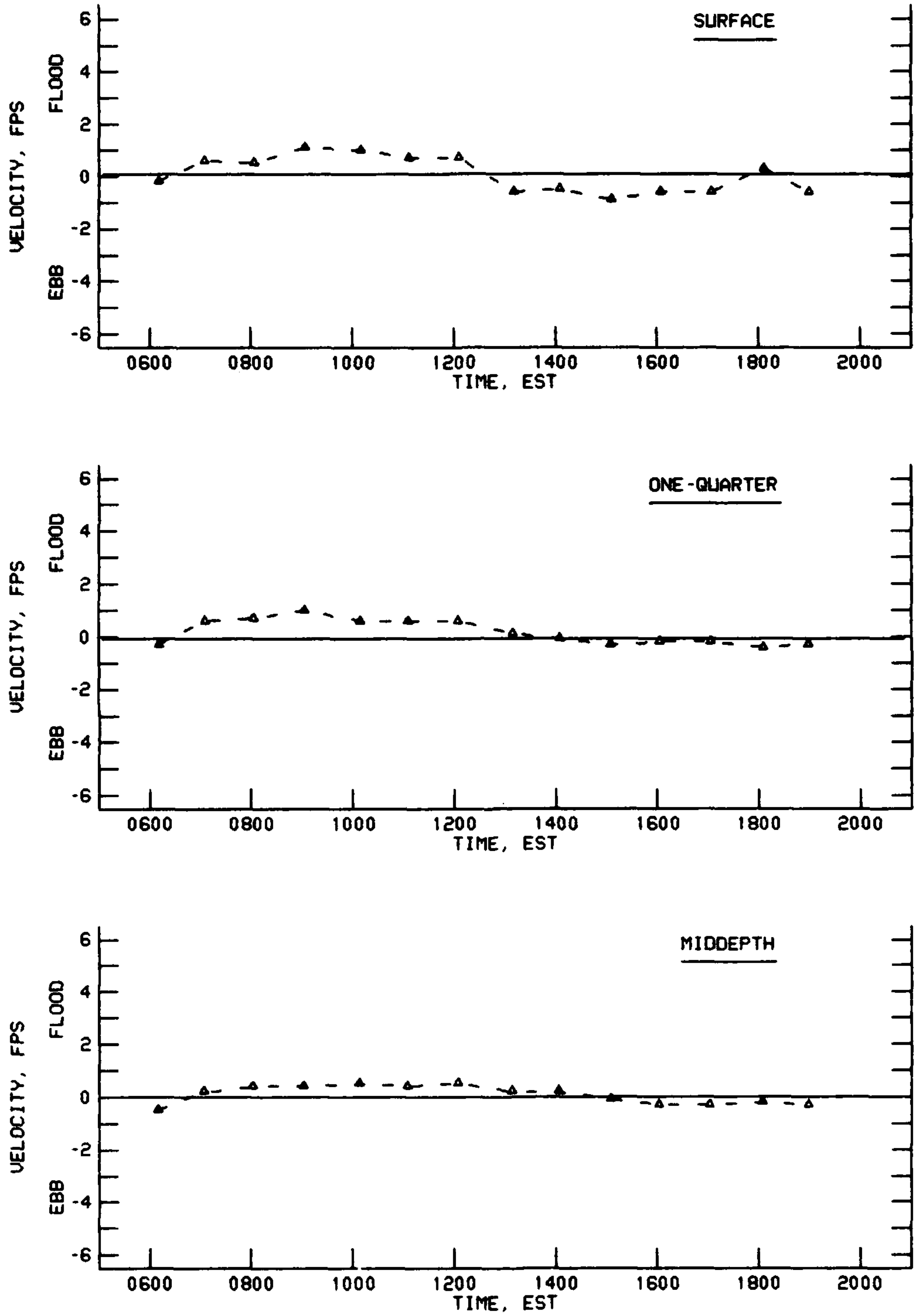
PLATE 26
(Sheet 1 of 2)



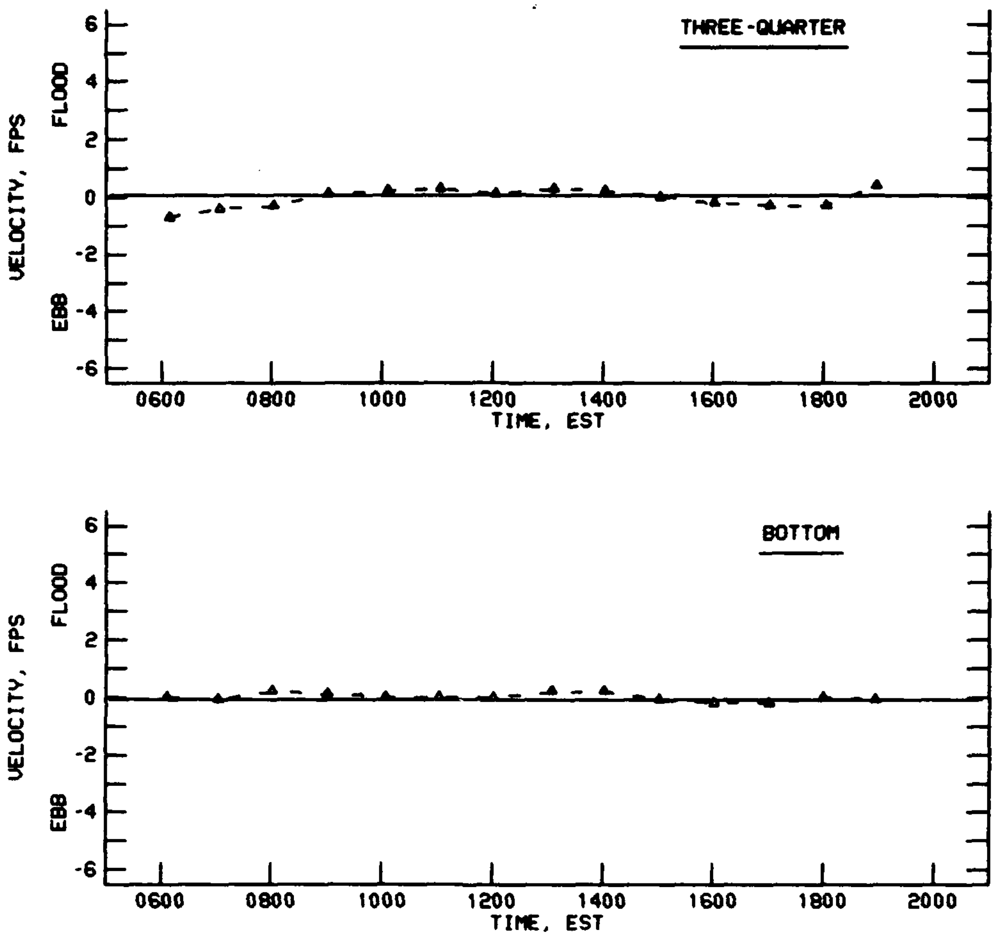


VELOCITIES AT STATION 4D
8 MAY 1990

PLATE 26
(Sheet 2 of 2)

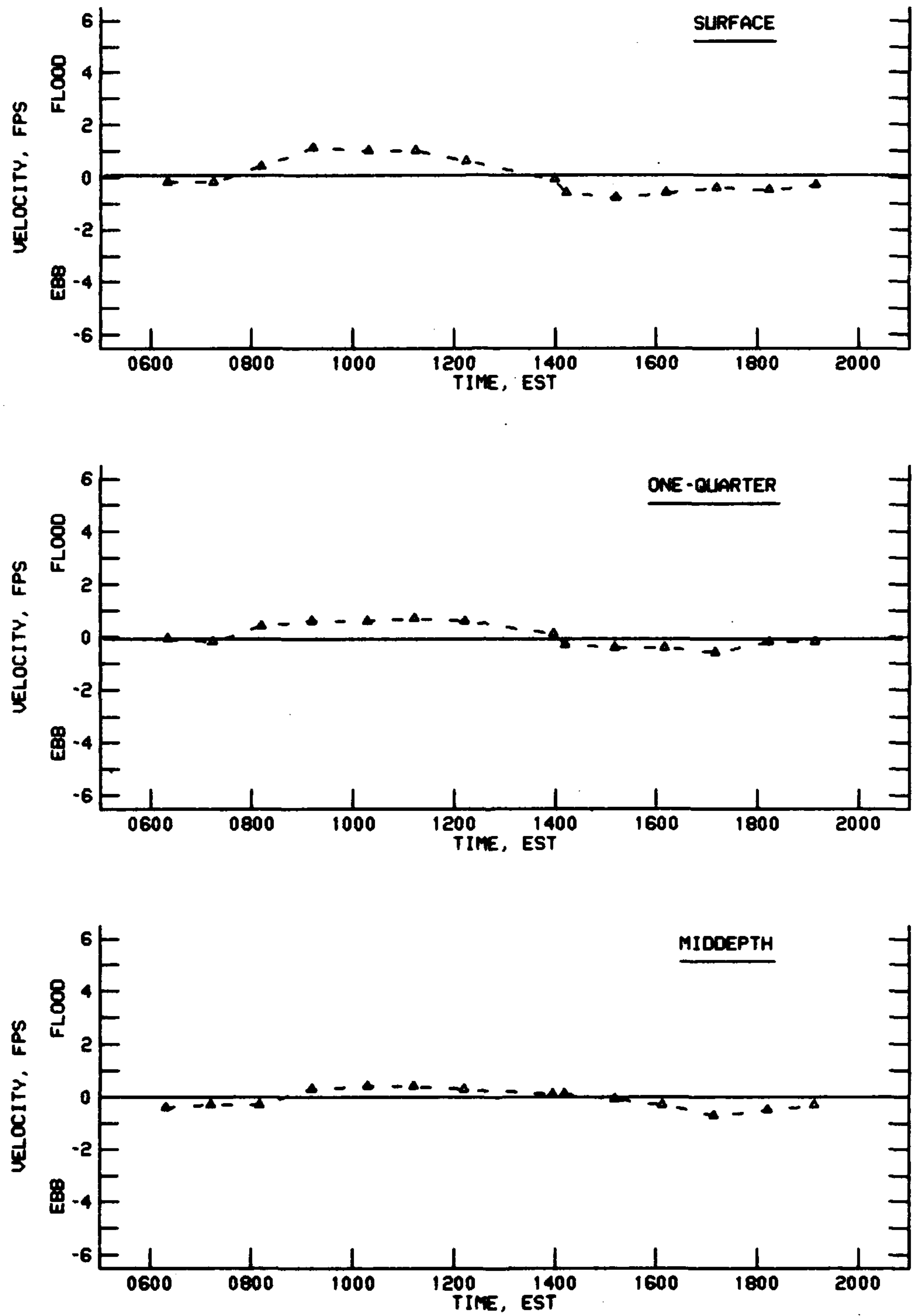


VELOCITIES AT STATION 5A
8 MAY 1990

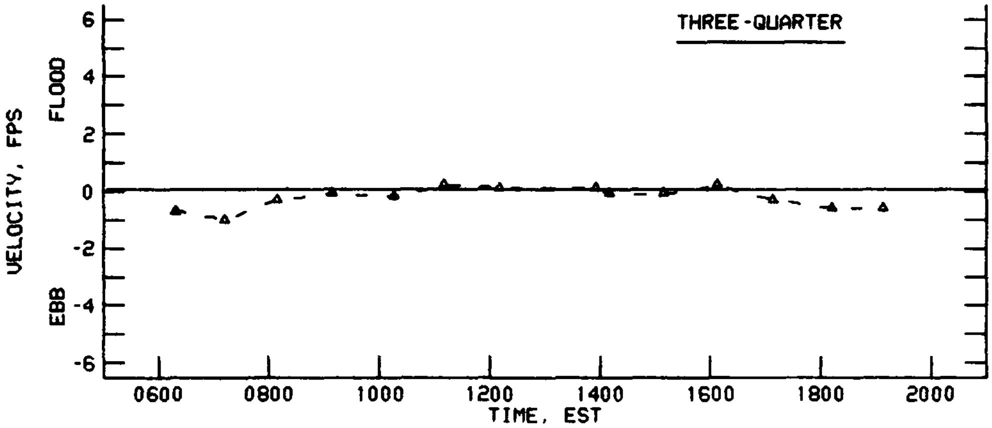


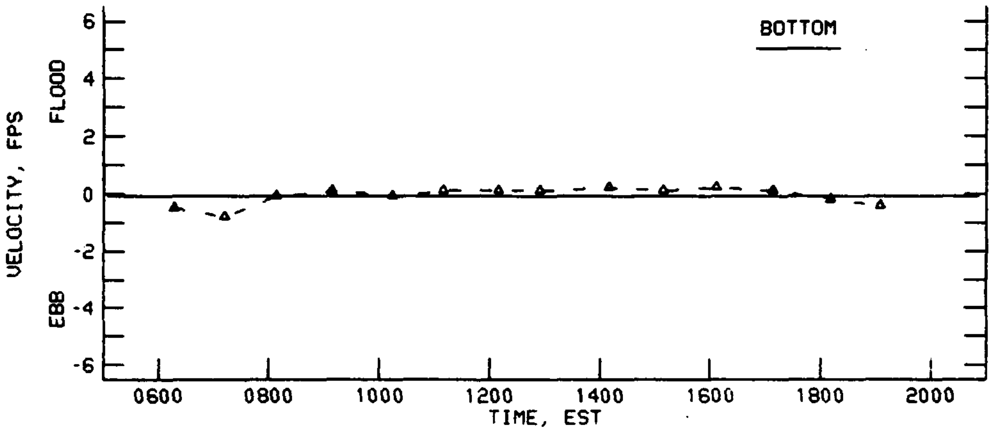
VELOCITIES AT STATION 5A
8 MAY 1990

PLATE 27
(Sheet 2 of 2)



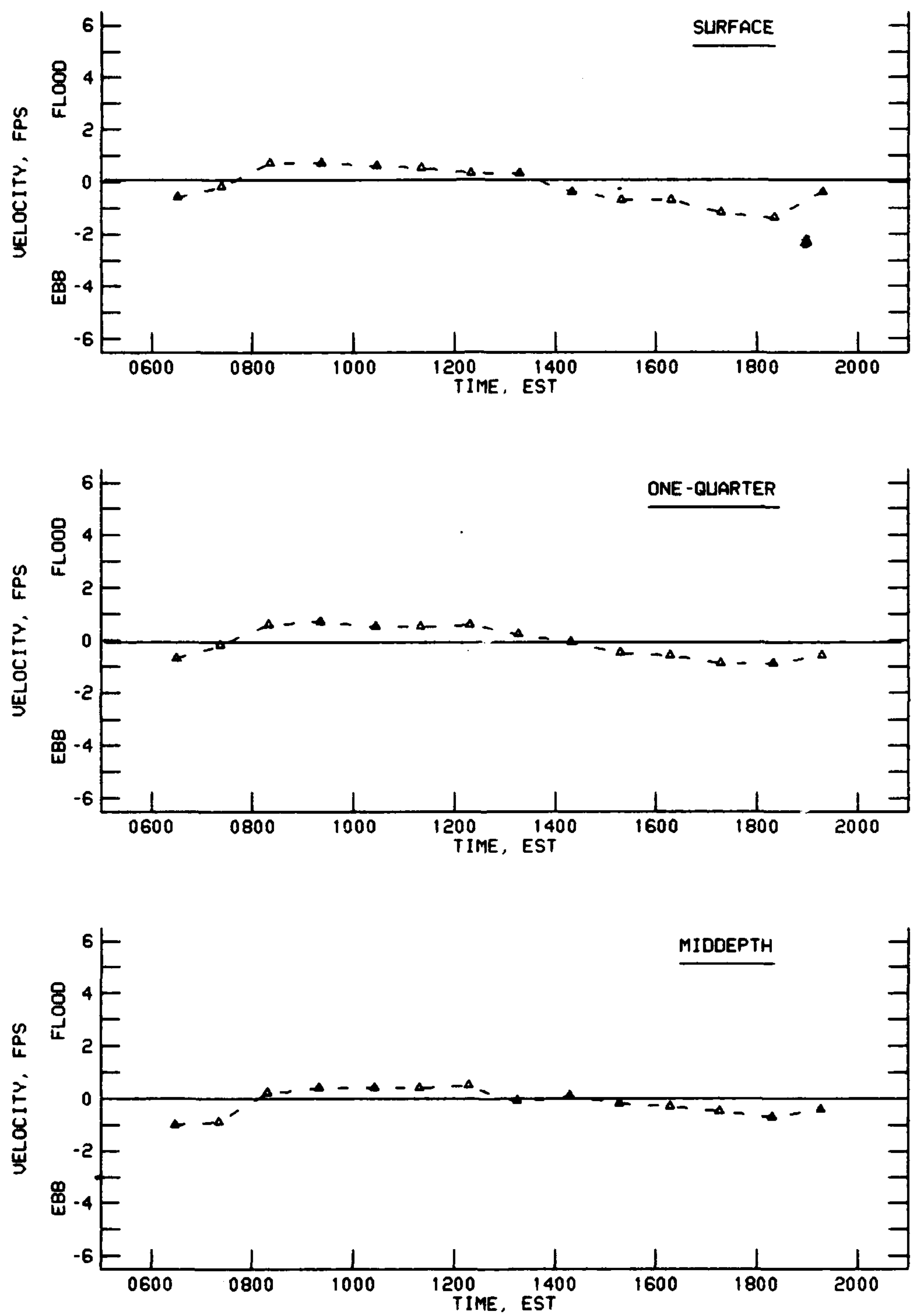
VELOCITIES AT STATION 5B
8 MAY 1990



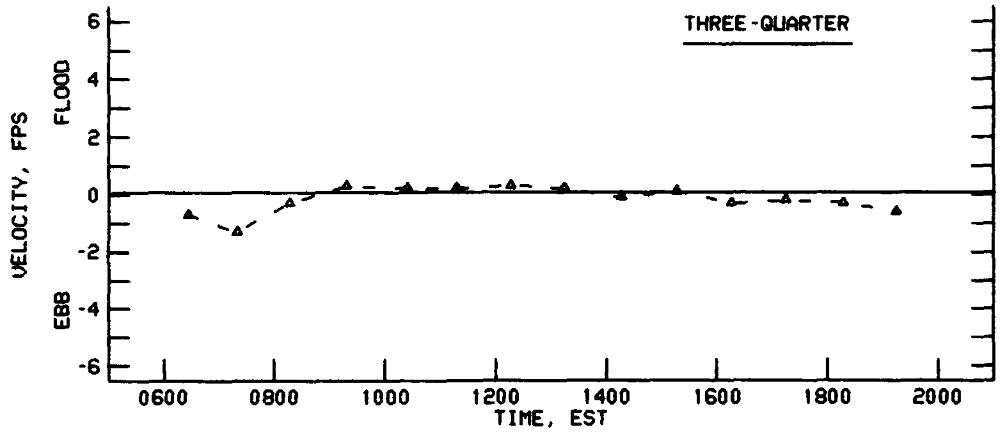


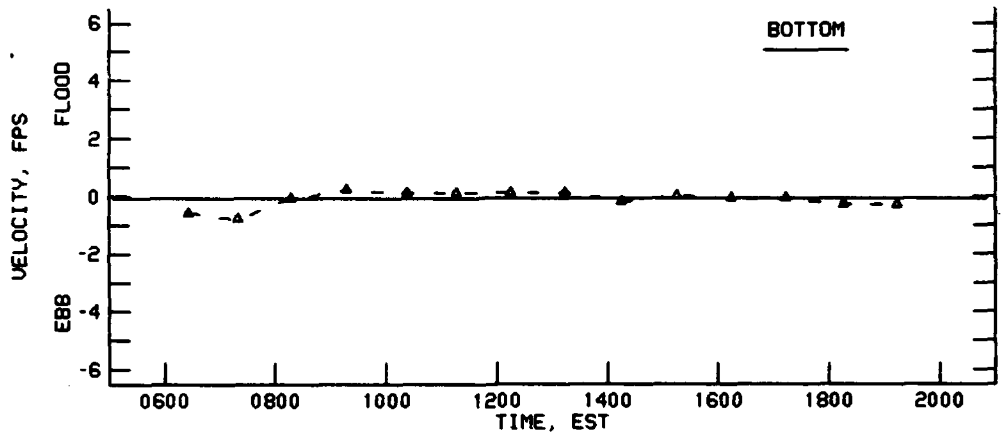
VELOCITIES AT STATION 5B
8 MAY 1990

PLATE 28
(Sheet 2 of 2)



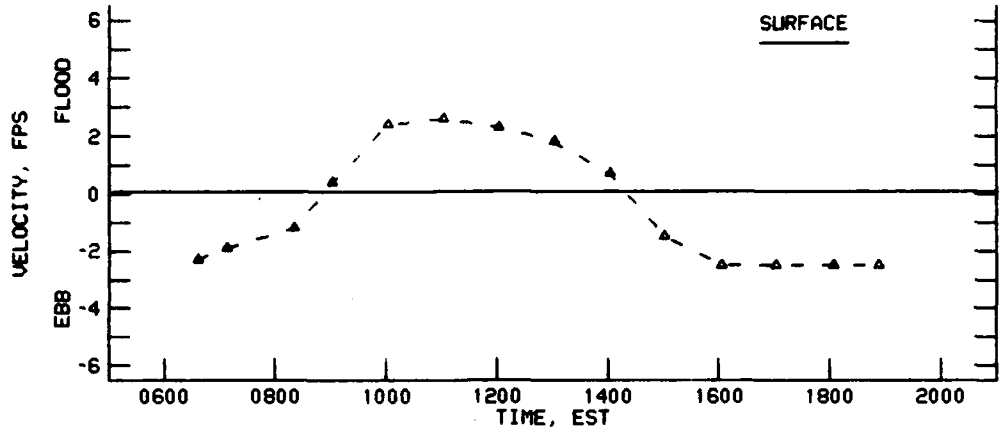
VELOCITIES AT STATION 5C
8 MAY 1990

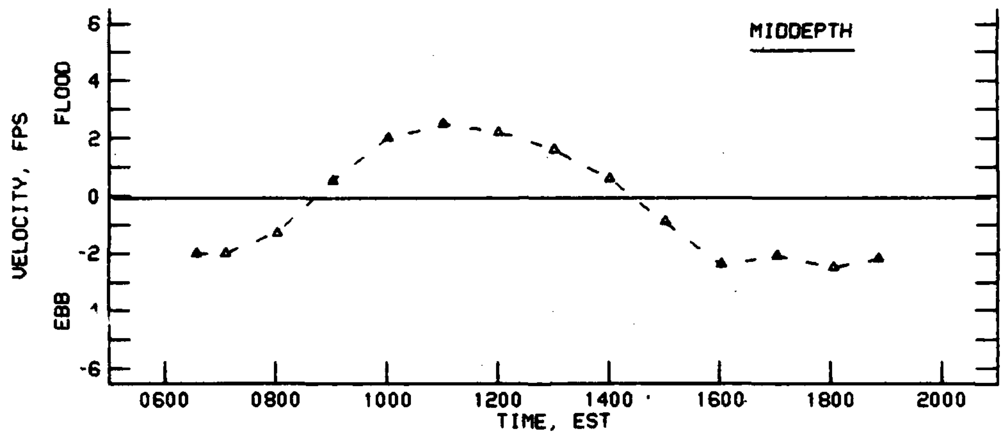


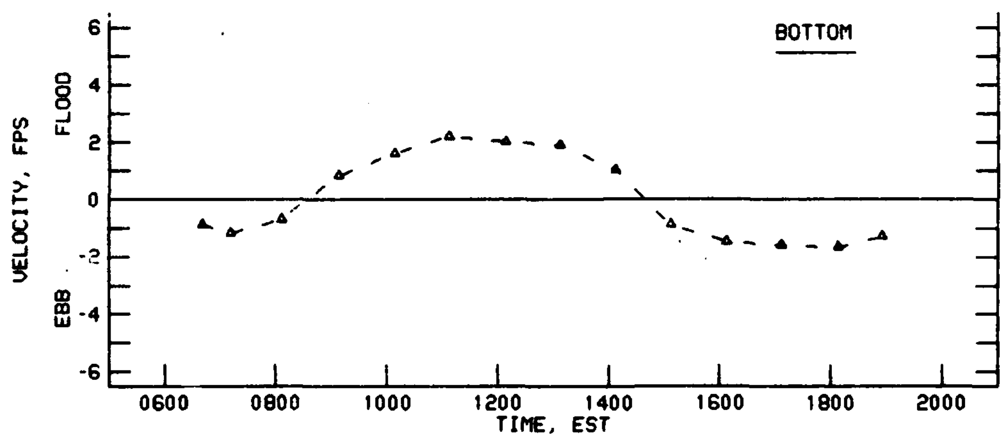


VELOCITIES AT STATION 5C
8 MAY 1990

PLATE 29
(Sheet 2 of 2)

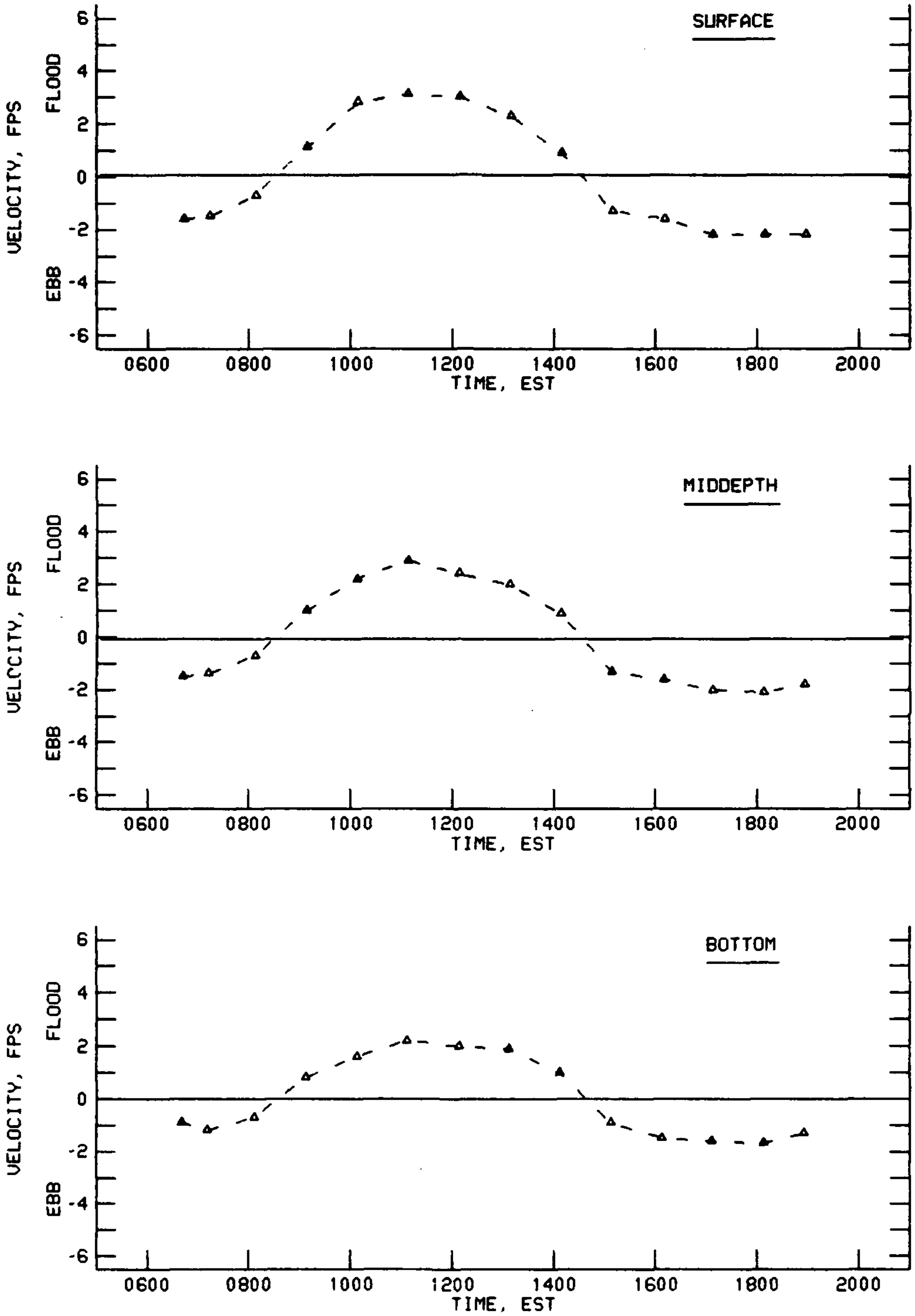




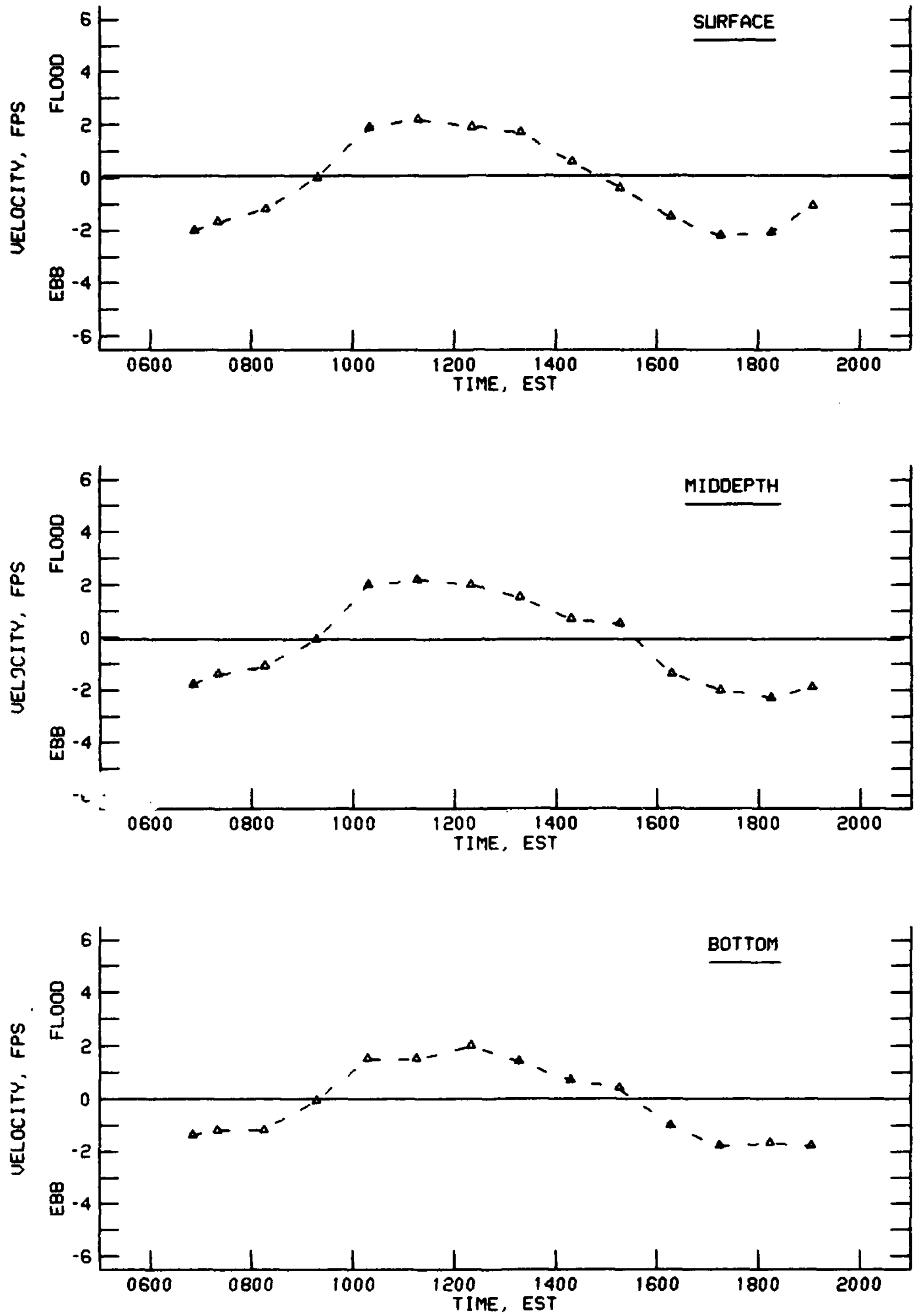


VELOCITIES AT STATION 7A

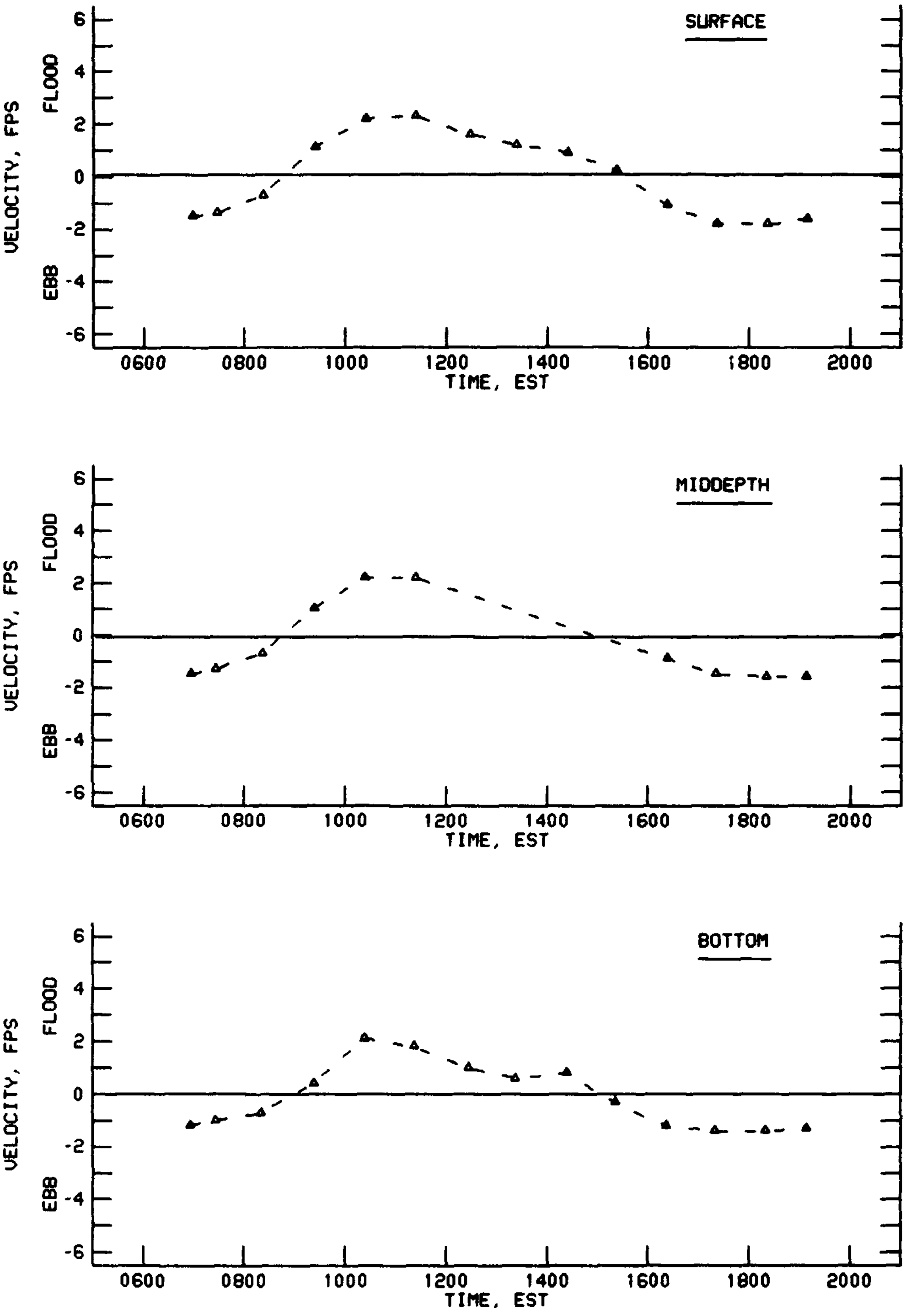
8 MAY 1990



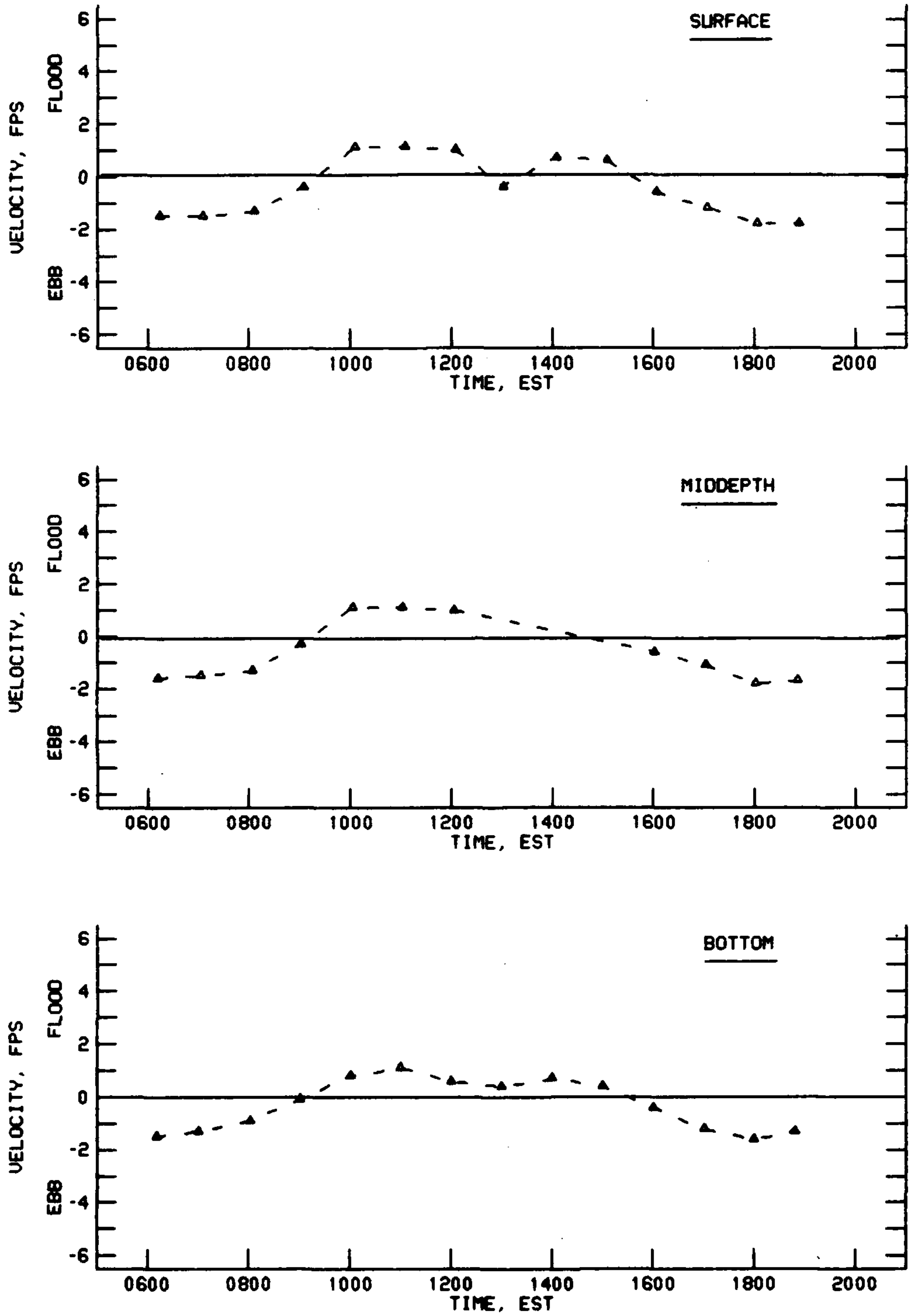
VELOCITIES AT STATION 7B
8 MAY 1990



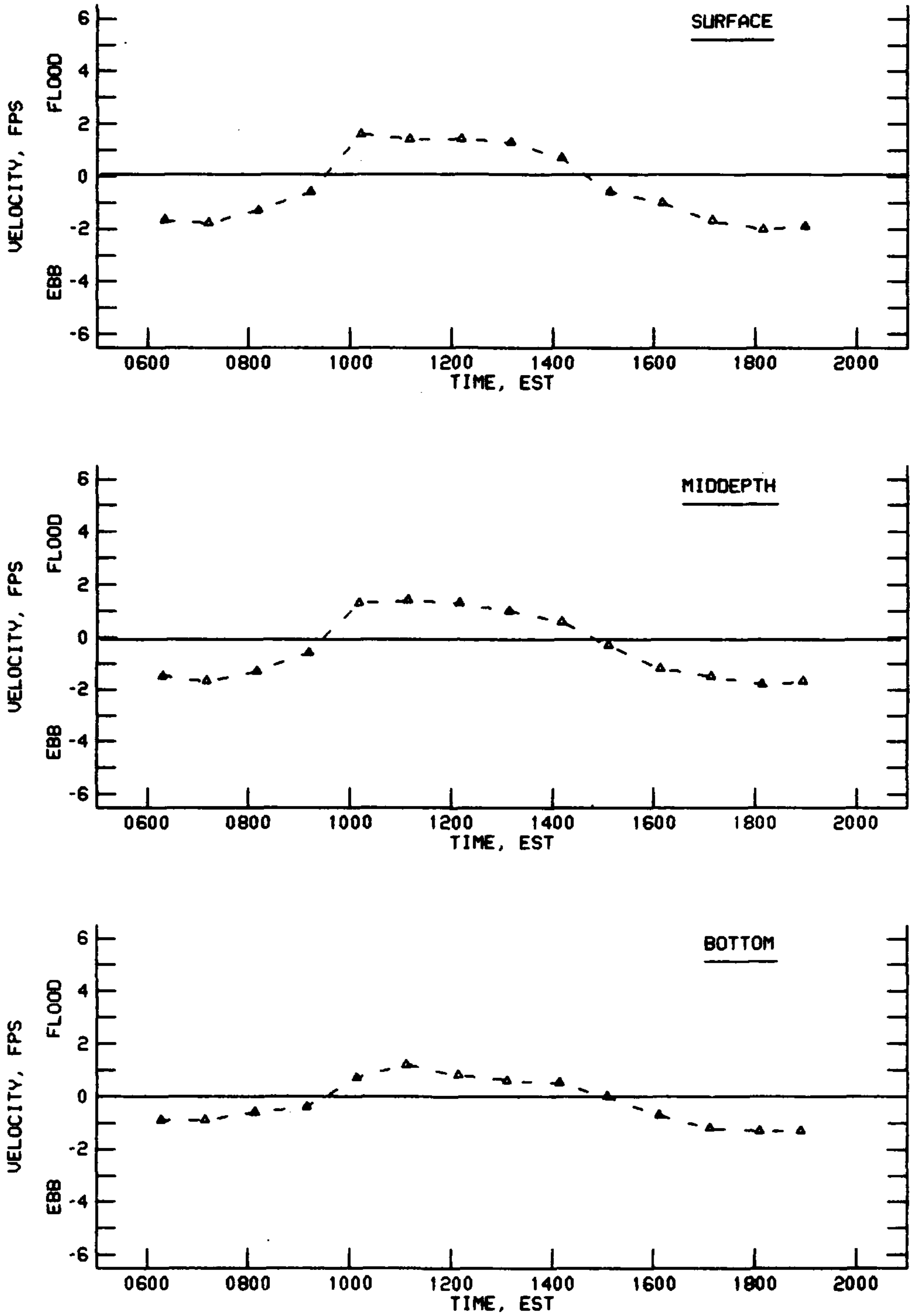
VELOCITIES AT STATION 7C
8 MAY 1990



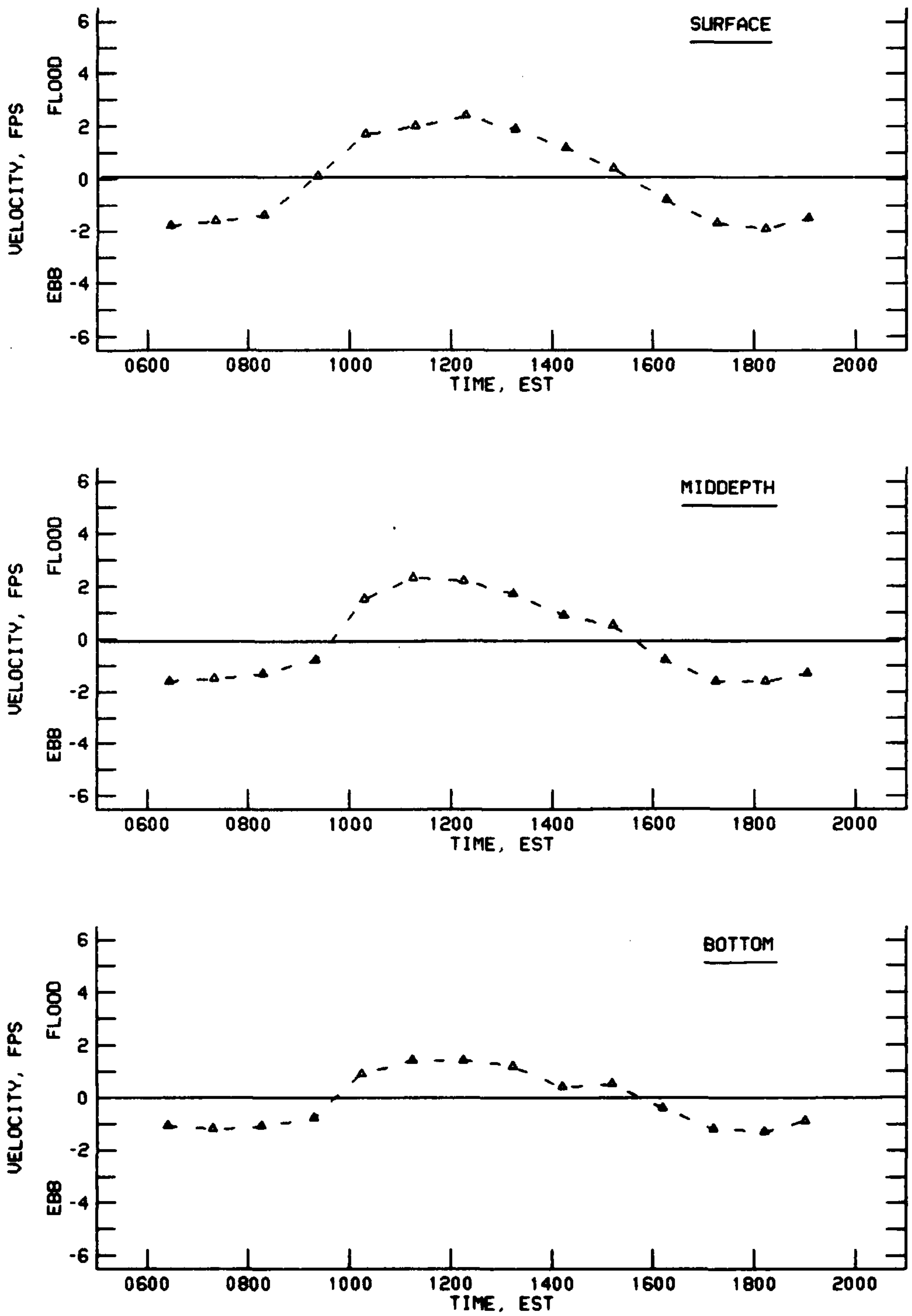
VELOCITIES AT STATION 7D
8 MAY 1990



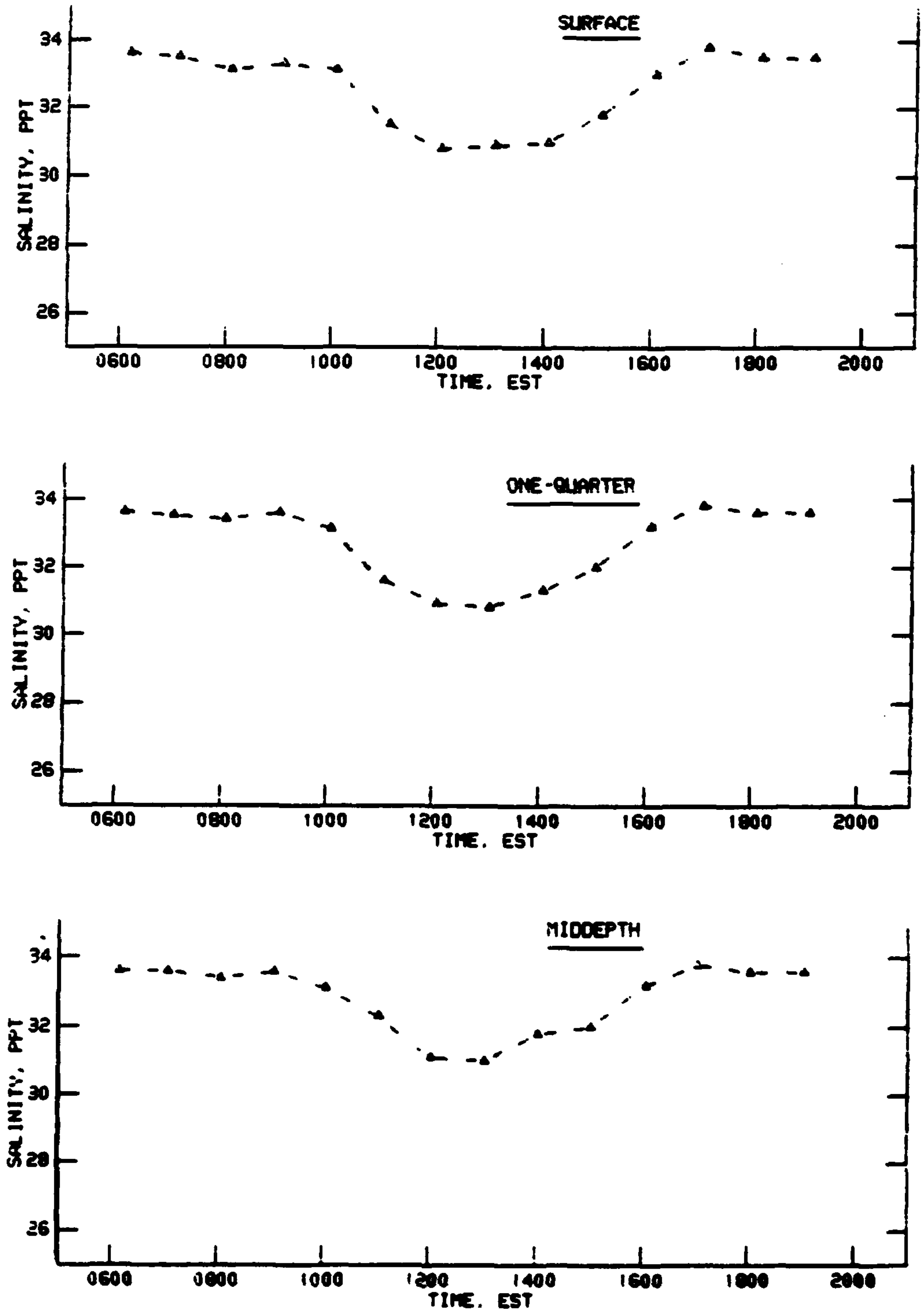
VELOCITIES AT STATION 8A
8 MAY 1990



VELOCITIES AT STATION 8B
8 MAY 1990

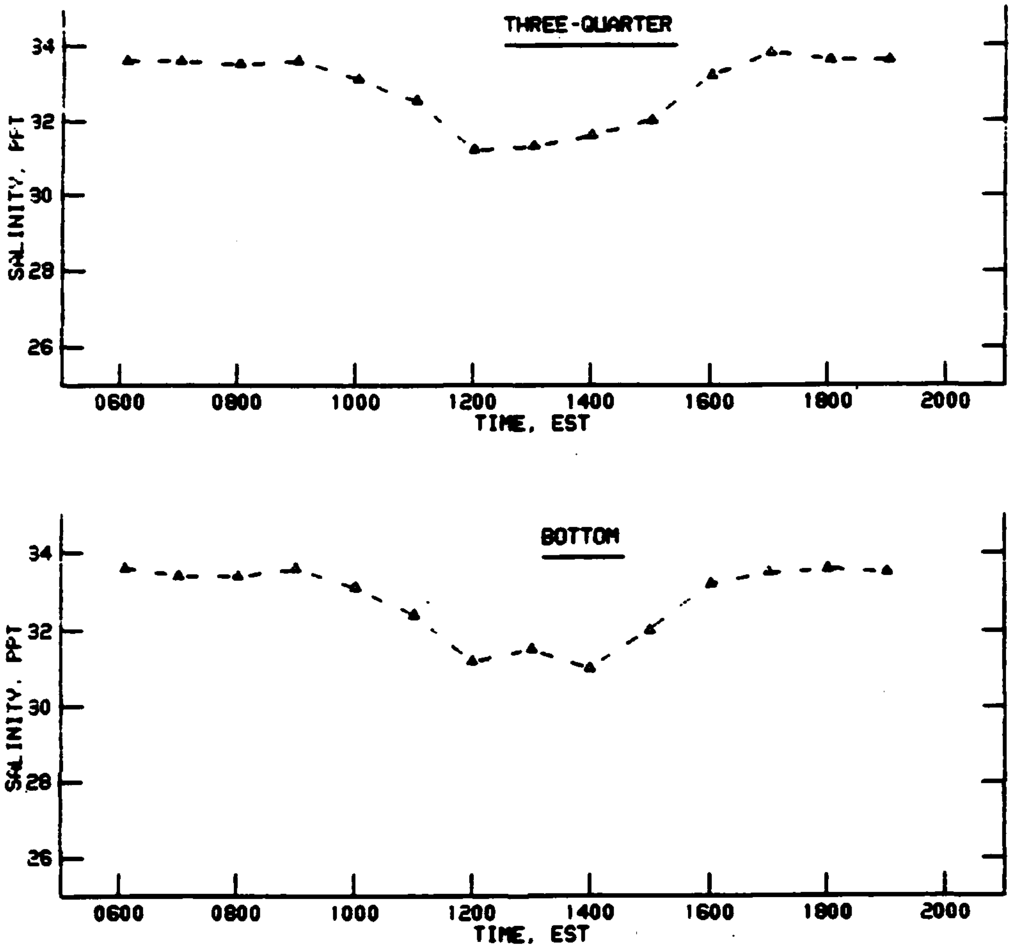


VELOCITIES AT STATION 8C
8 MAY 1990

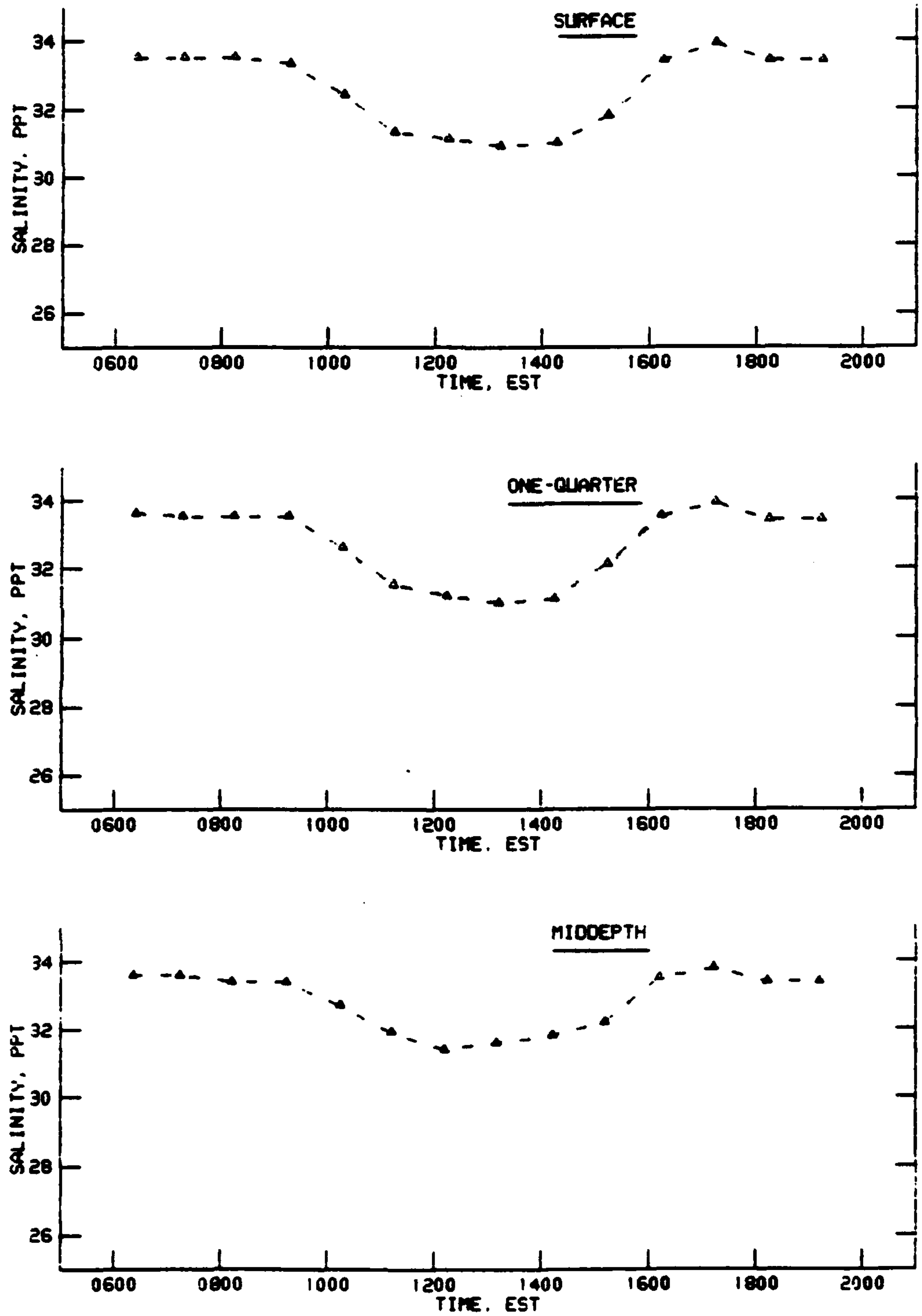


SALINITY AT STATION 1A
7 MAY 1990

PLATE 37
(Sheet 1 of 2)

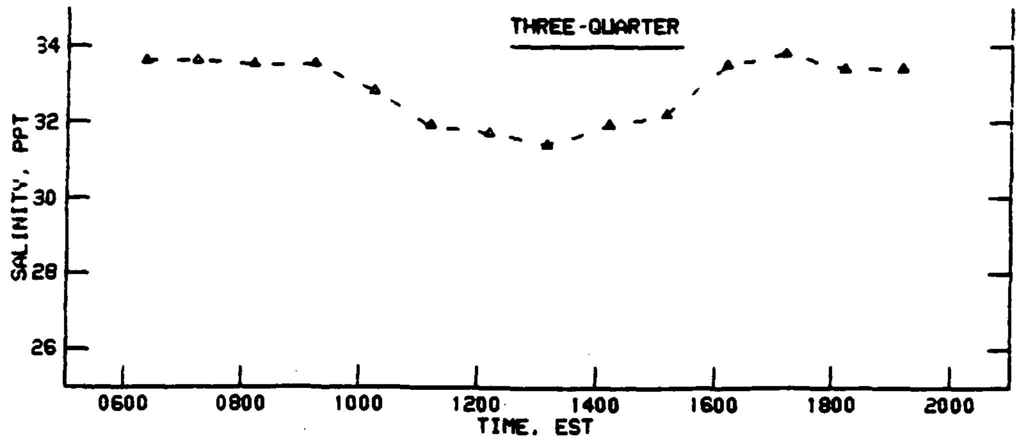


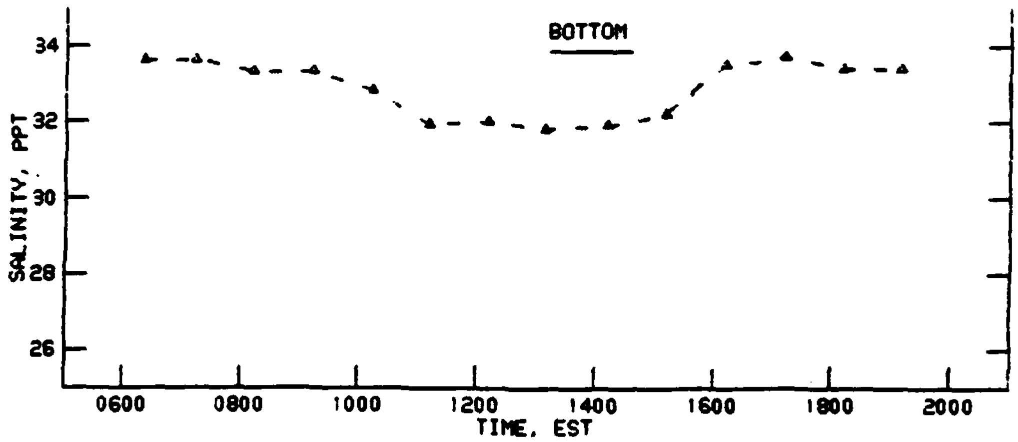
SALINITY AT STATION 1A
7 MAY 1990



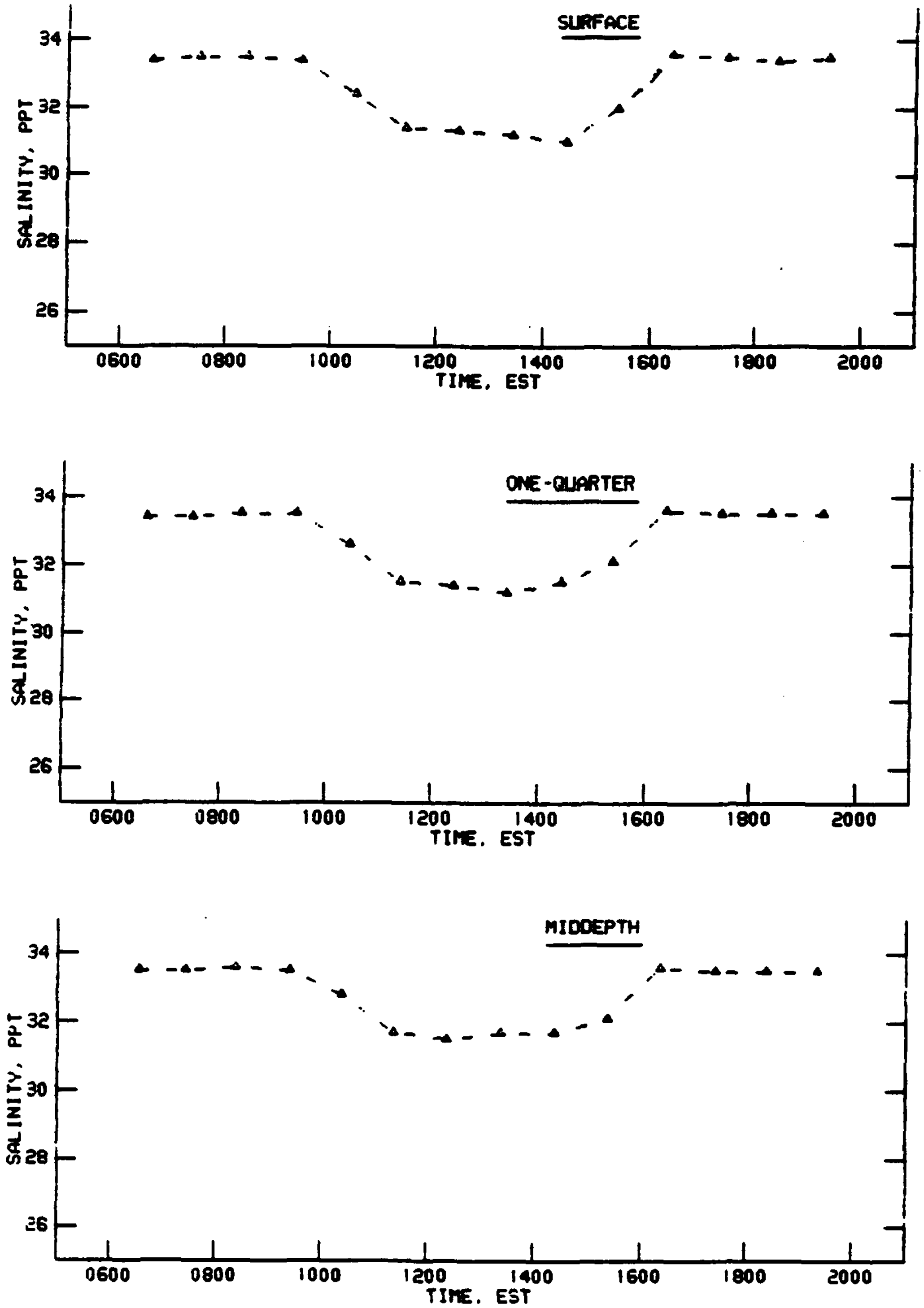
SALINITY AT STATION 1B
7 MAY 1990

PLATE 38
(Sheet 1 of 2)



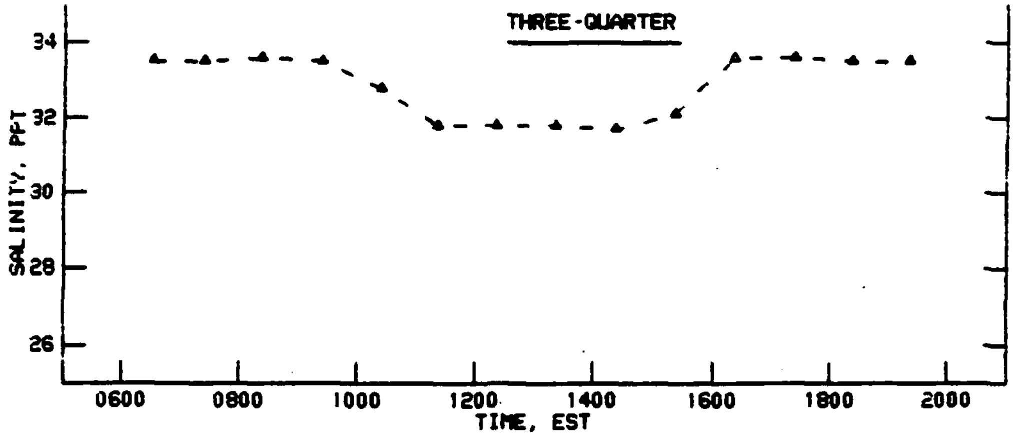


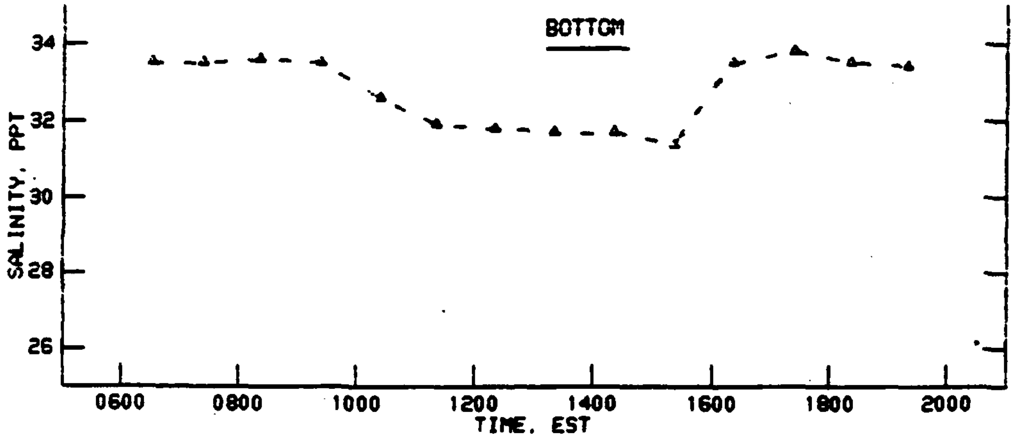
SALINITY AT STATION 1B
7 MAY 1990



SALINITY AT STATION 1C
7 MAY 1990

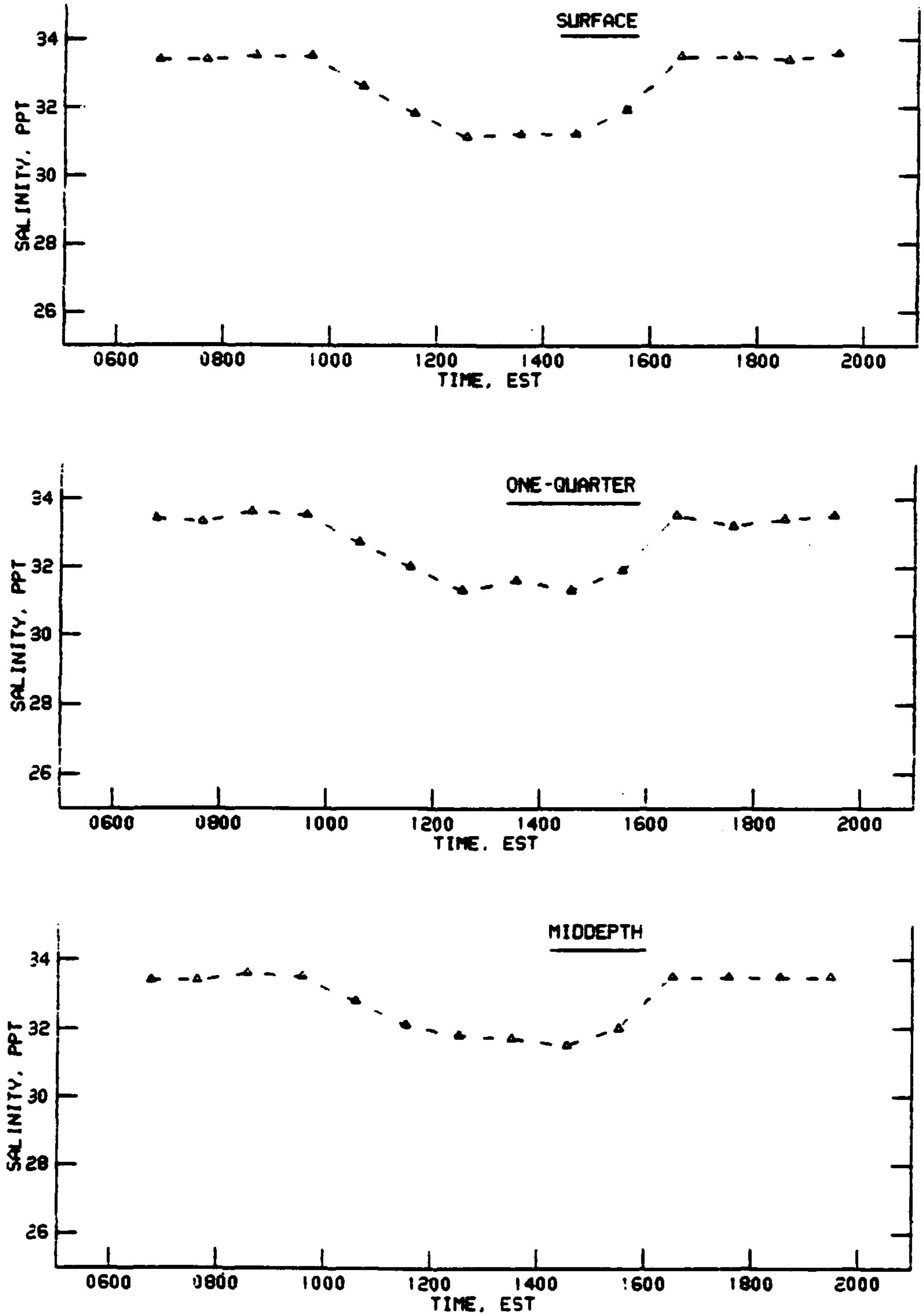
PLATE 39
(Sheet 1 of 2)





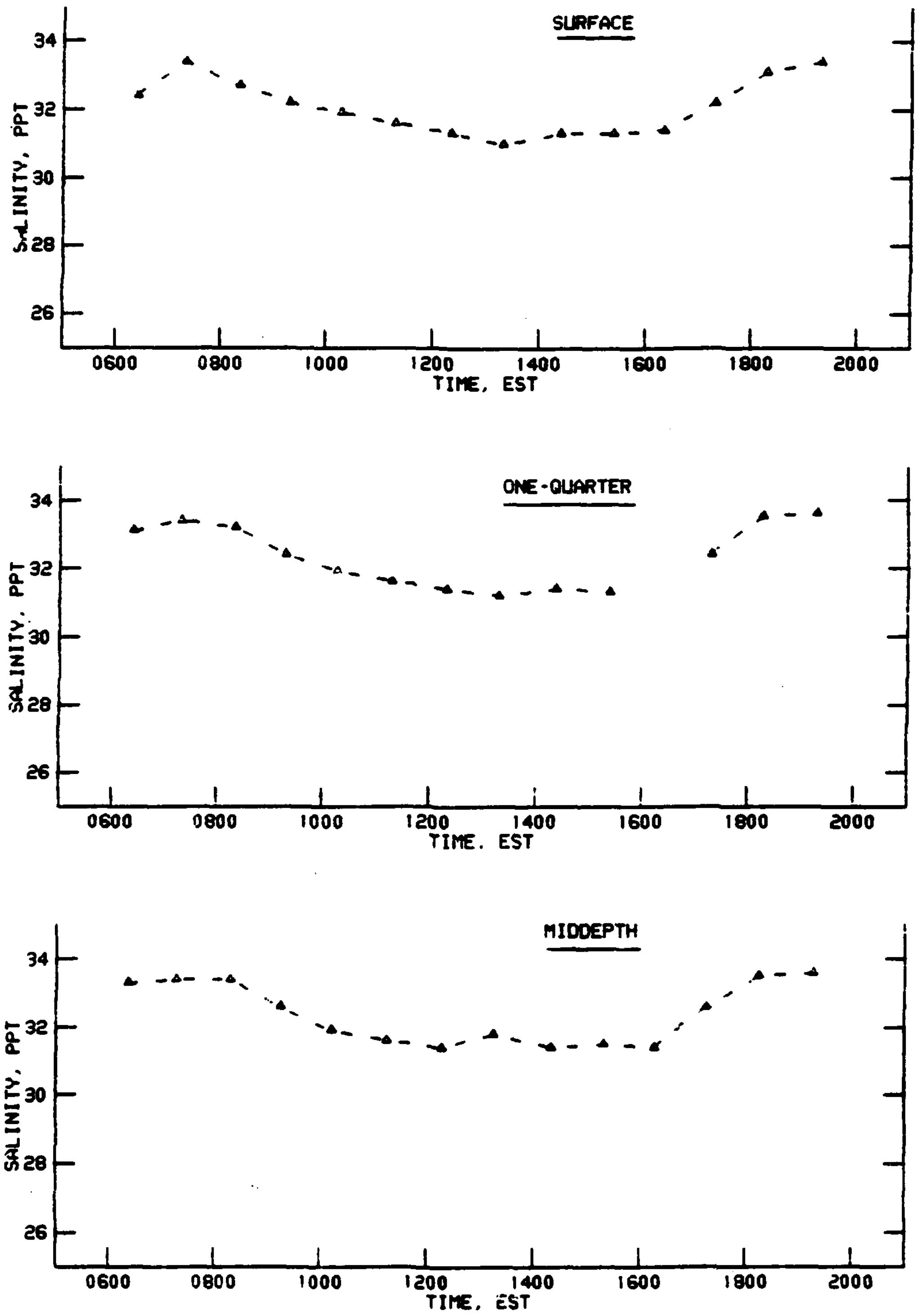
SALINITY AT STATION 1C
7 MAY 1990

PLATE 39
(Sheet 2 of 2)



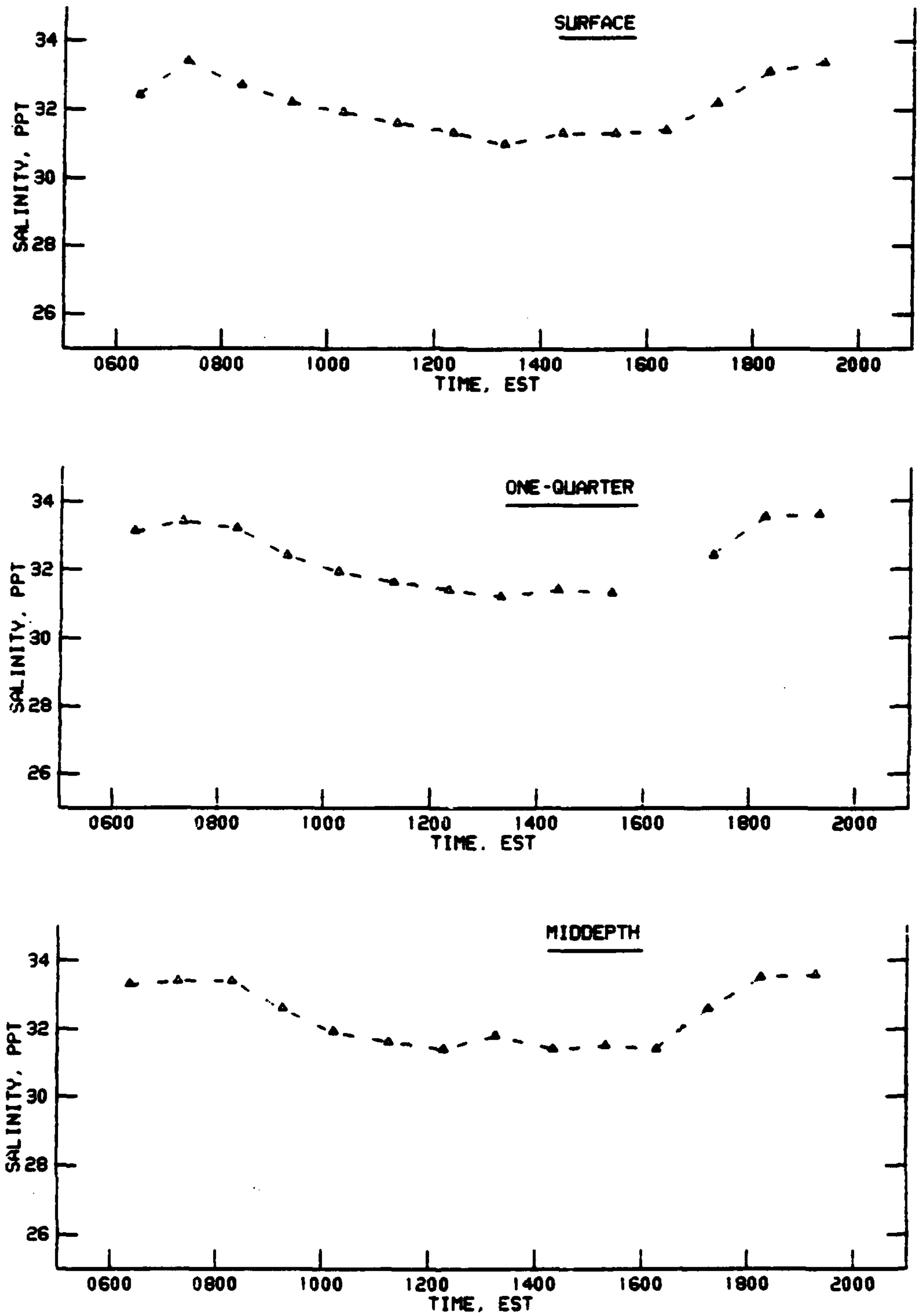
SALINITY AT STATION 1D
7 MAY 1990

PLATE 40
(Sheet 1 of 2)



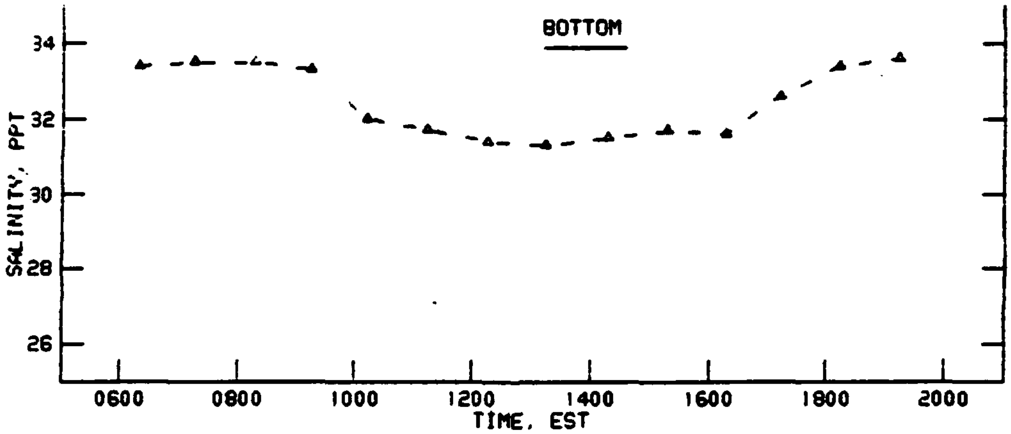
SALINITY AT STATION 2A
7 MAY 1990

PLATE 41
(Sheet 1 of 2)

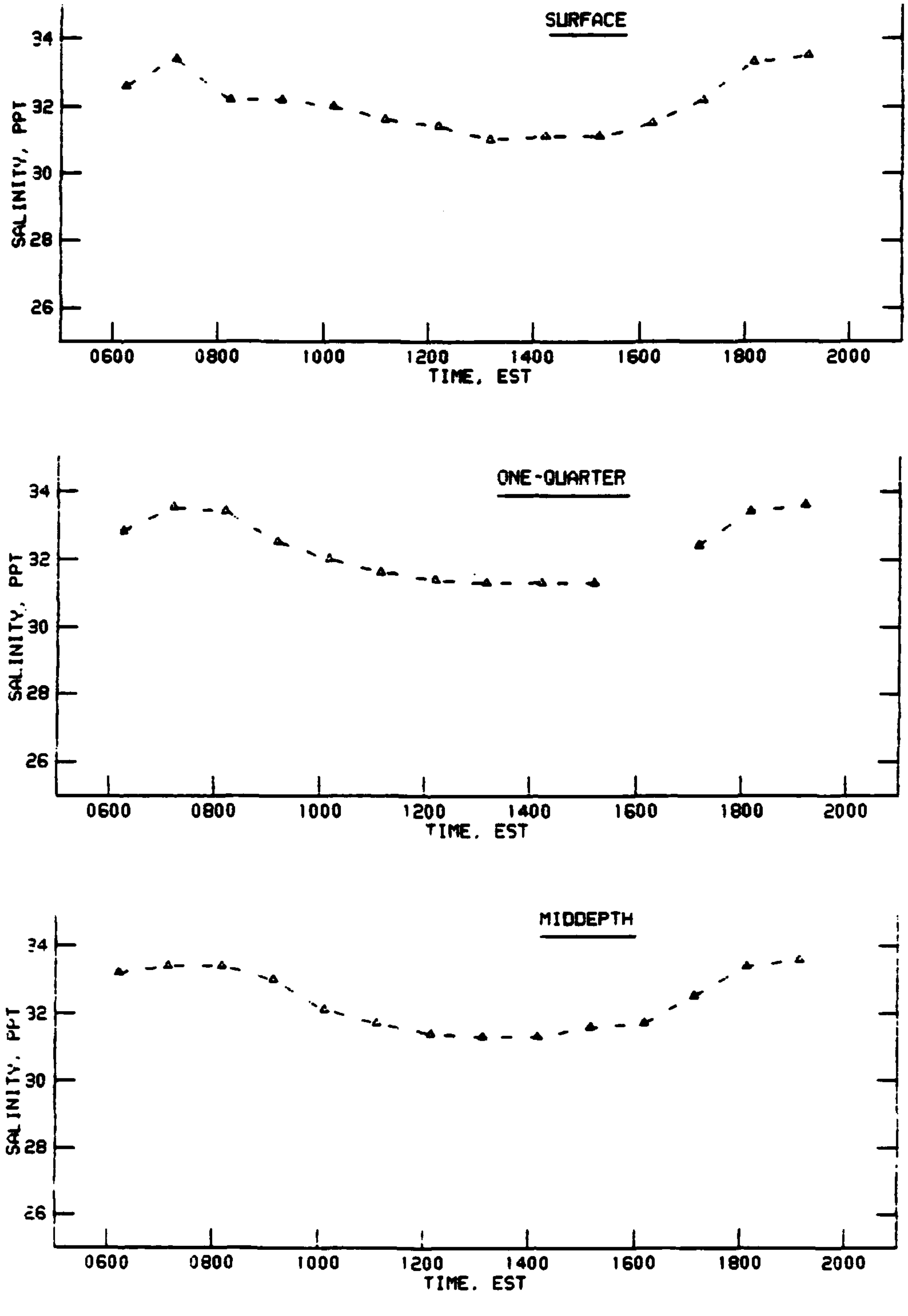


SALINITY AT STATION 2A
7 MAY 1990

PLATE 41
(Sheet 1 of 2)

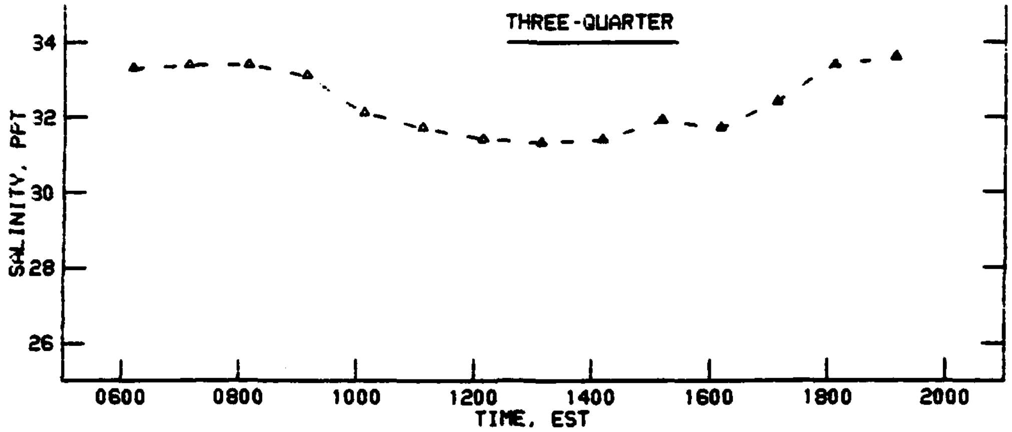


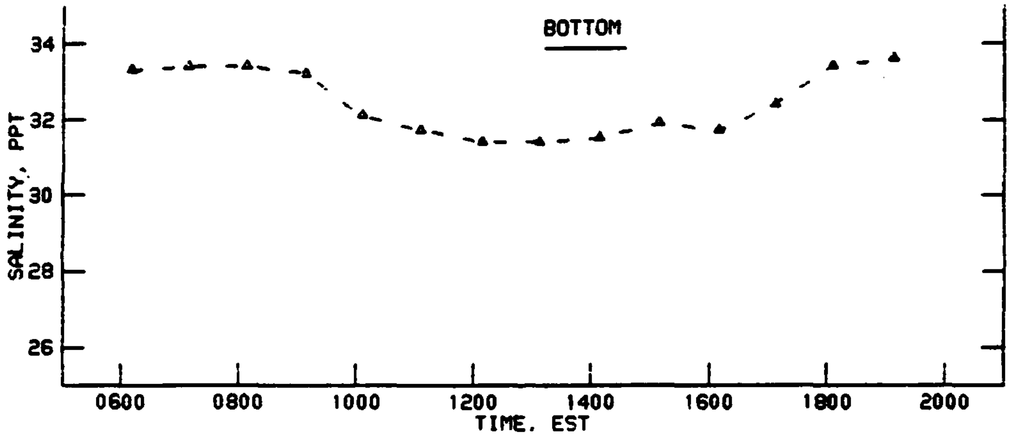
SALINITY AT STATION 2A
7 MAY 1990



SALINITY AT STATION 2B
7 MAY 1990

PLATE 42
(Sheet 1 of 2)

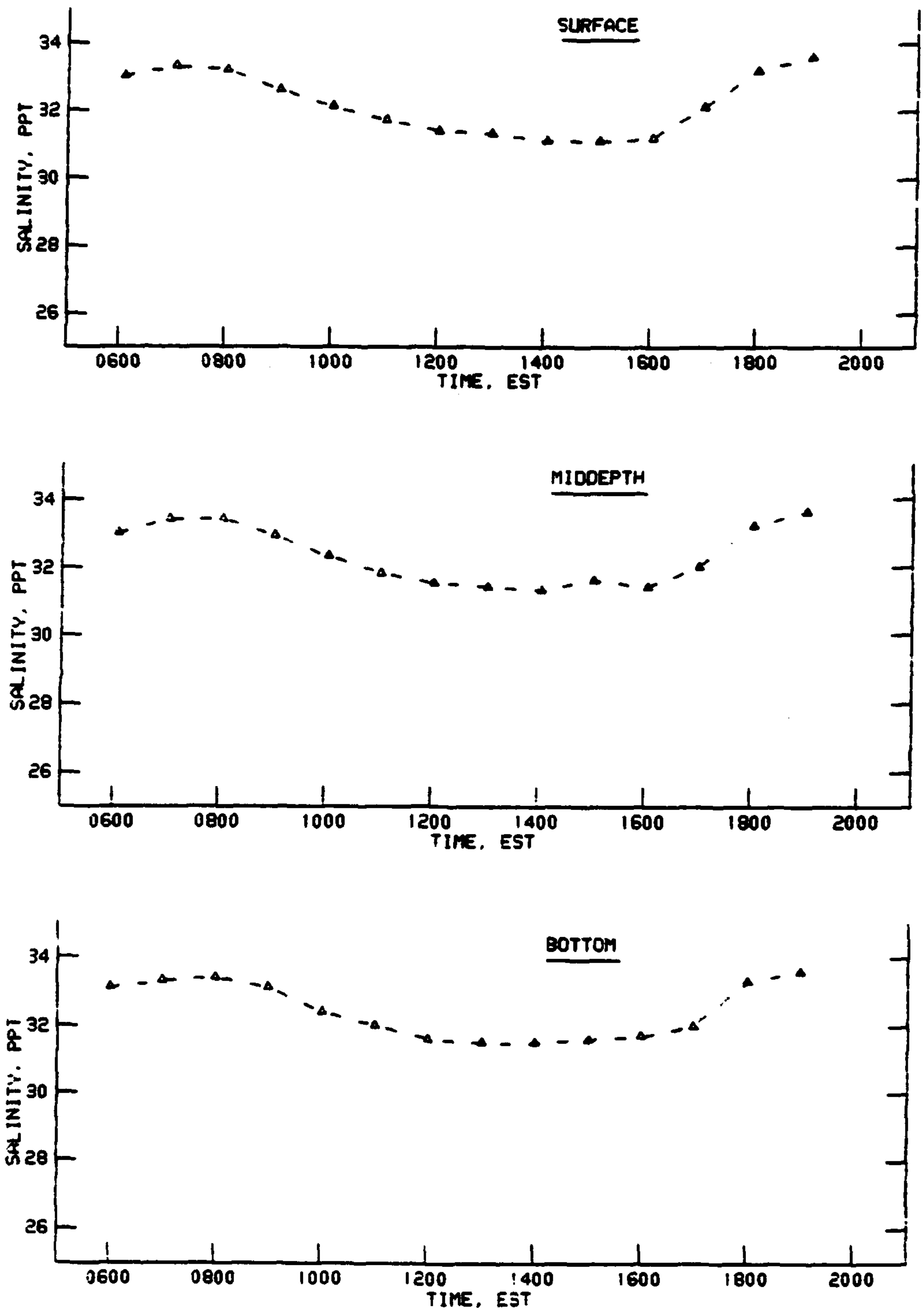




SALINITY AT STATION 2B

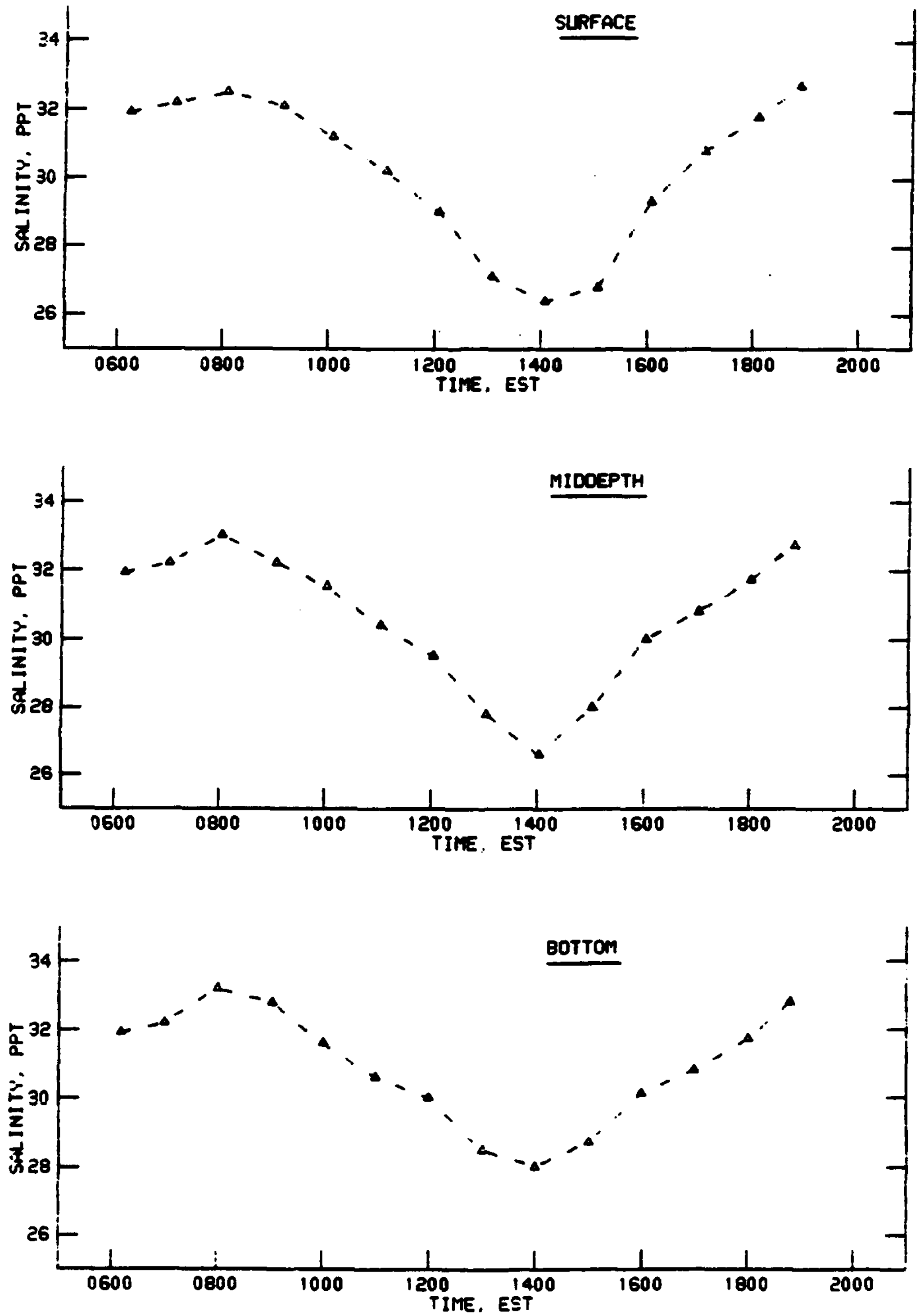
7 MAY 1990

PLATE 42
(Sheet 2 of 2)

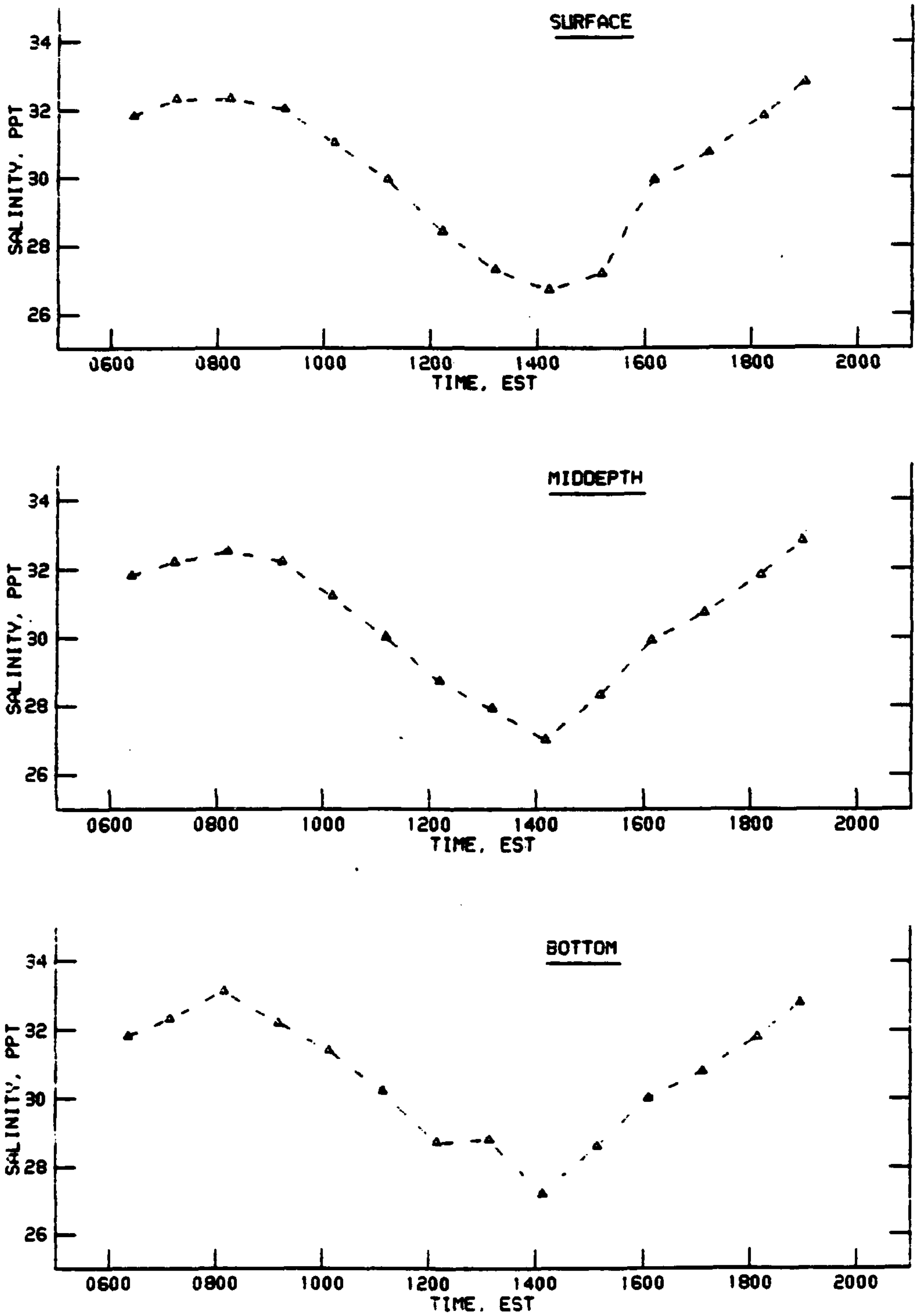


SALINITY AT STATION 2C
7 MAY 1990

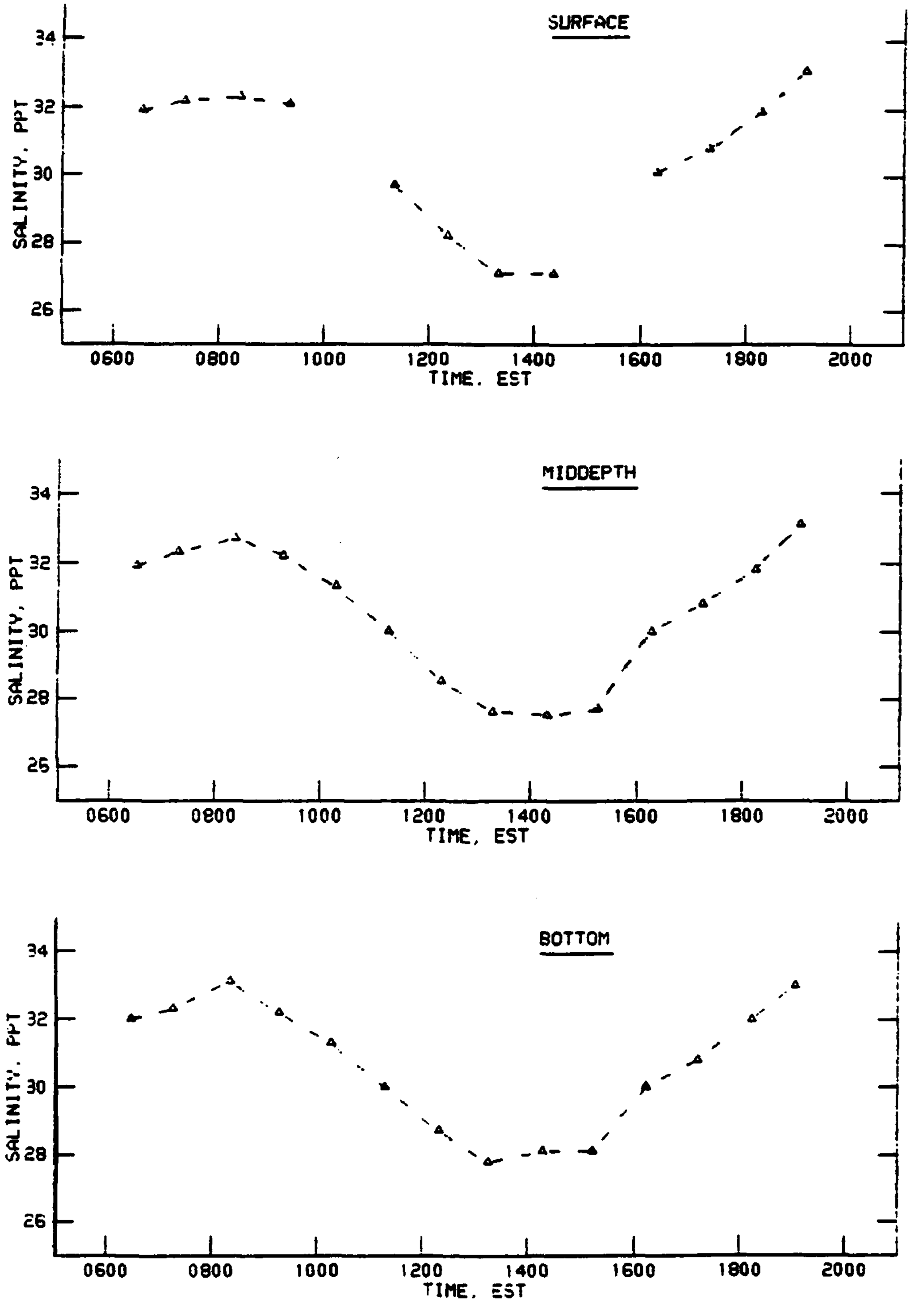
PLATE 43



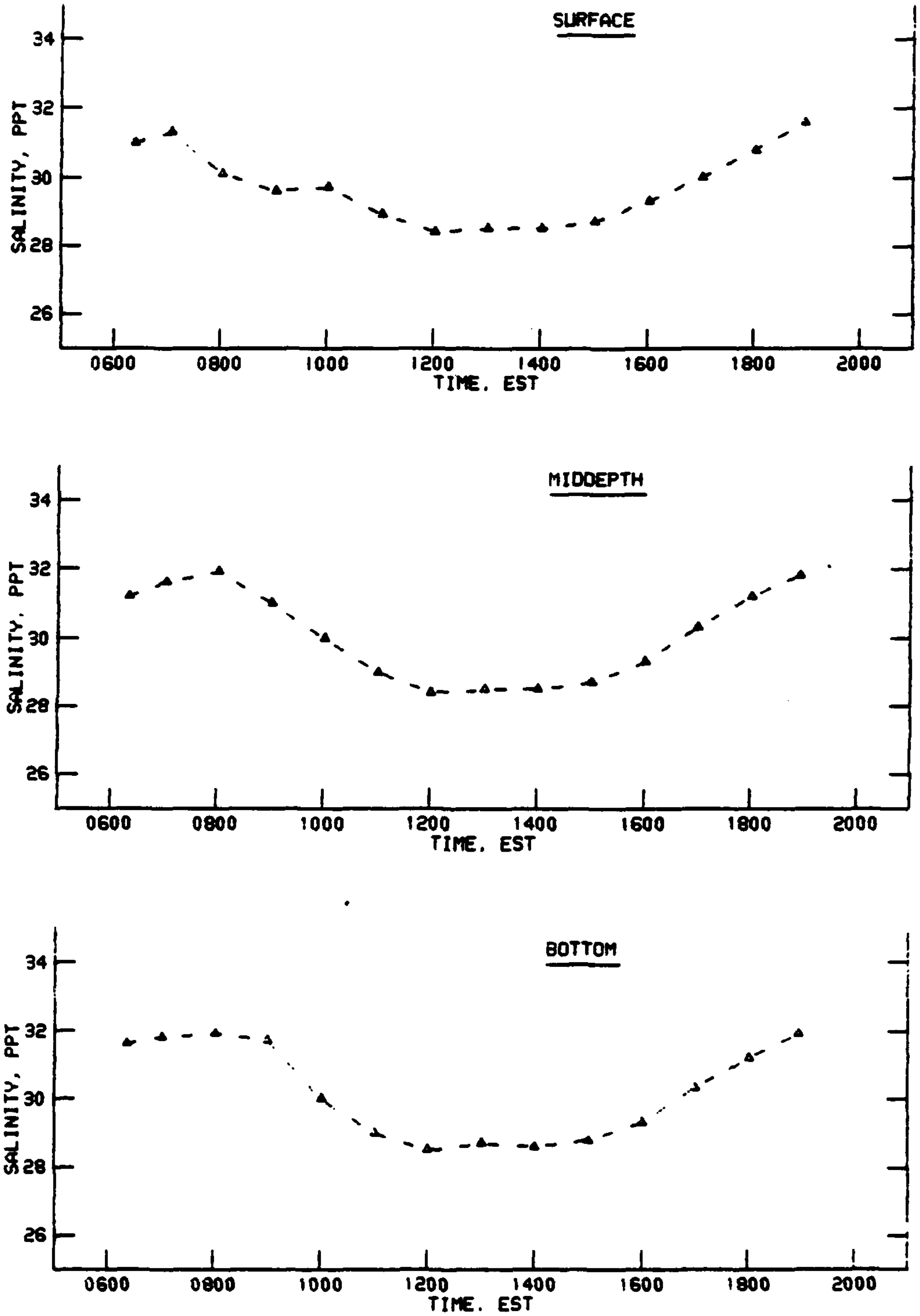
SALINITY AT STATION 3A
7 MAY 1990



SALINITY AT STATION 3B
7 MAY 1990

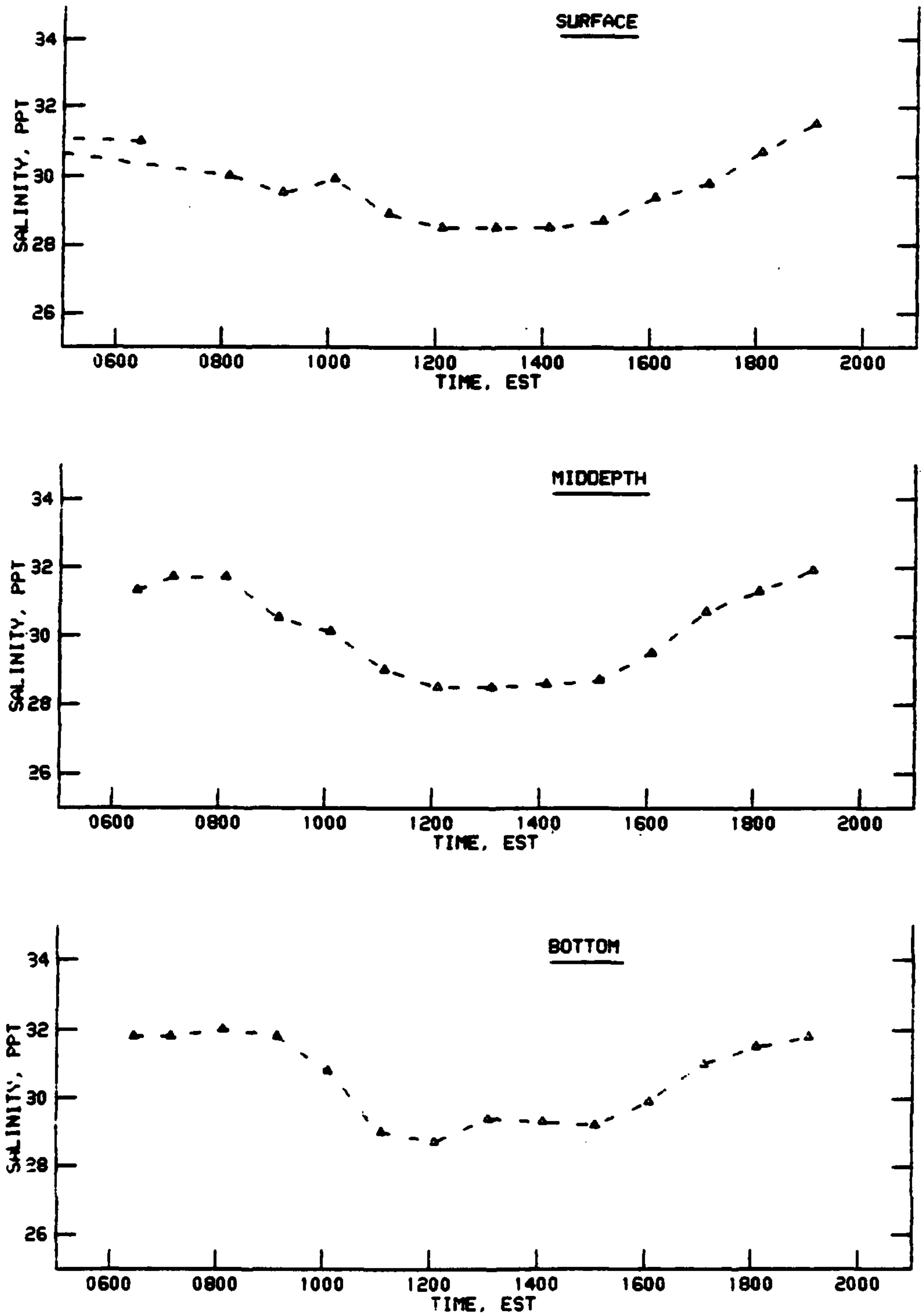


SALINITY AT STATION 3C
7 MAY 1990



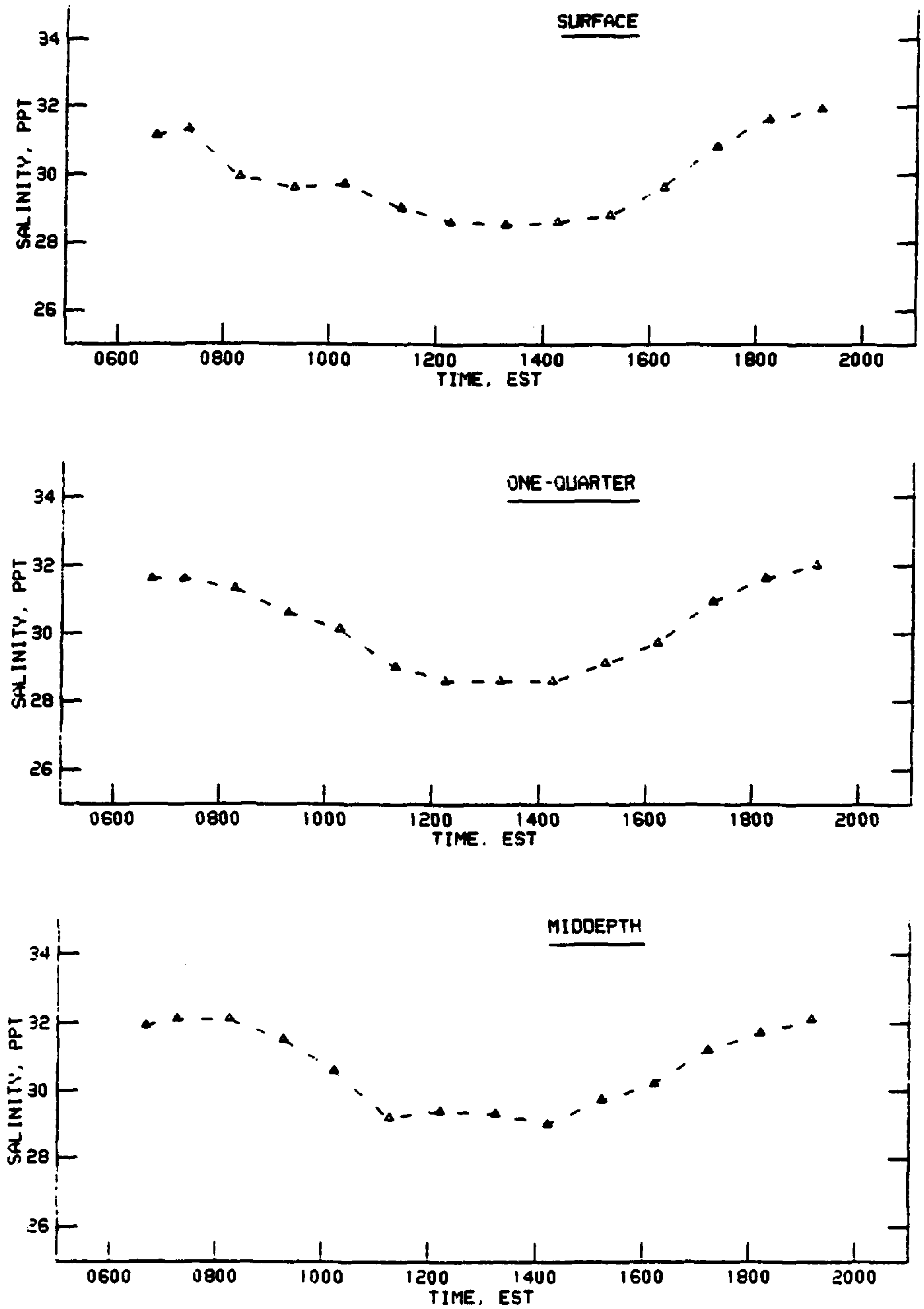
SALINITY AT STATION 4A
7 MAY 1990

PLATE 47



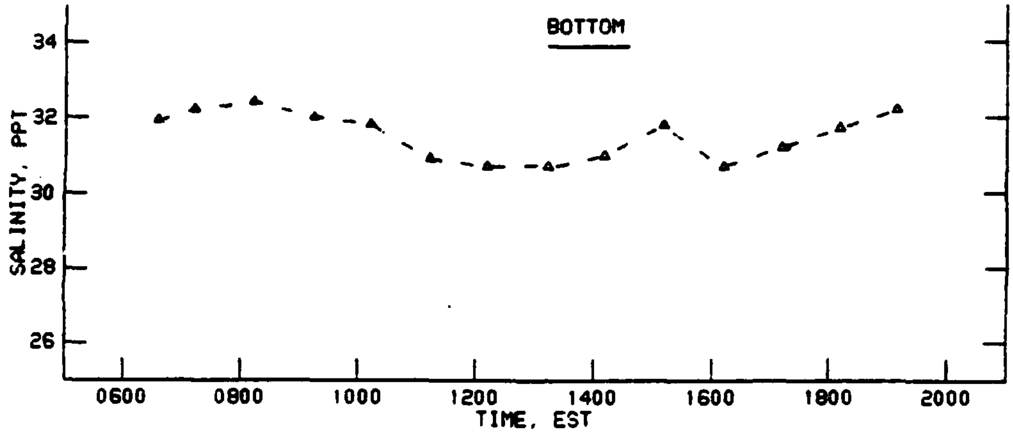
SALINITY AT STATION 4B

7 MAY 1990



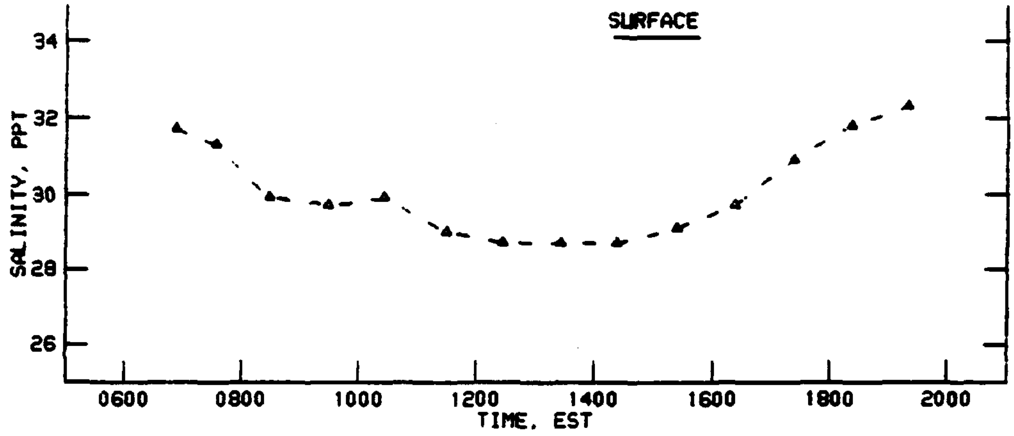
SALINITY AT STATION 4C
7 MAY 1990

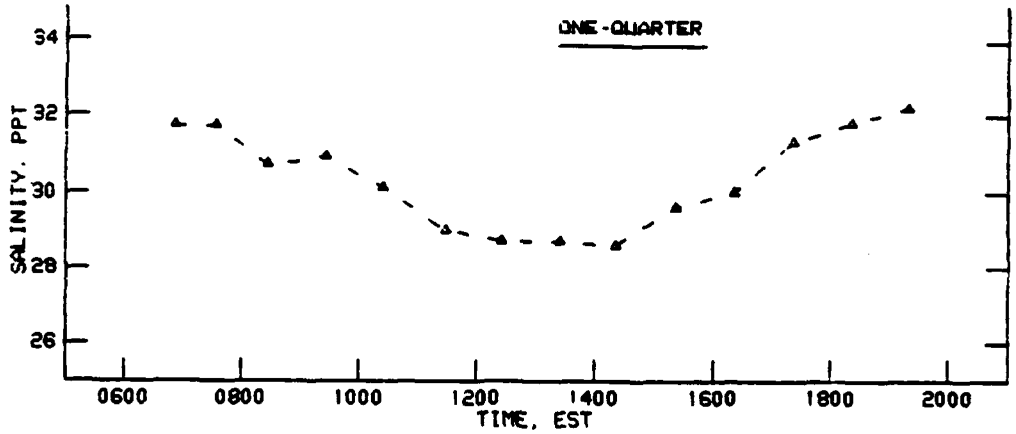
PLATE 49
(Sheet 1 of 2)

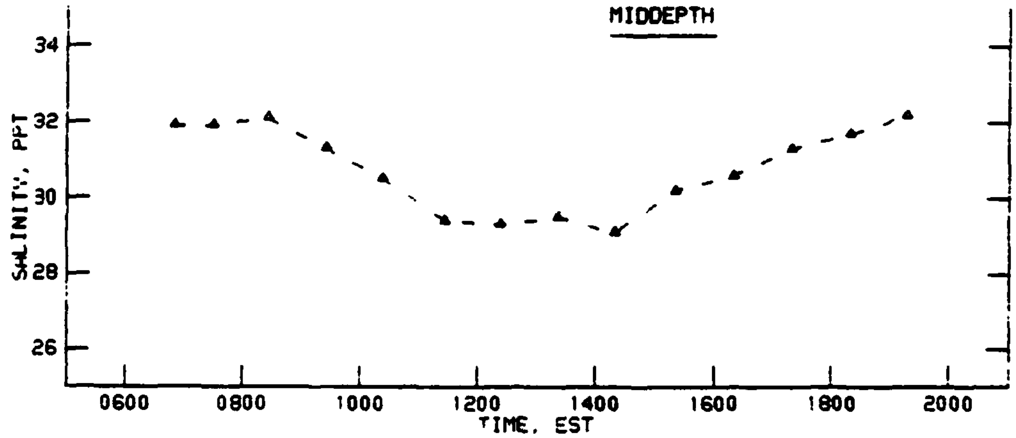


SALINITY AT STATION 4C

7 MAY 1990



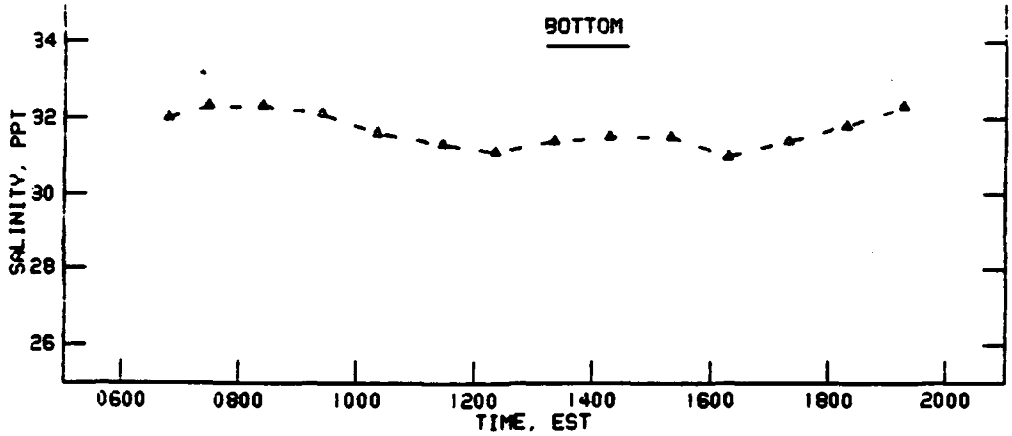




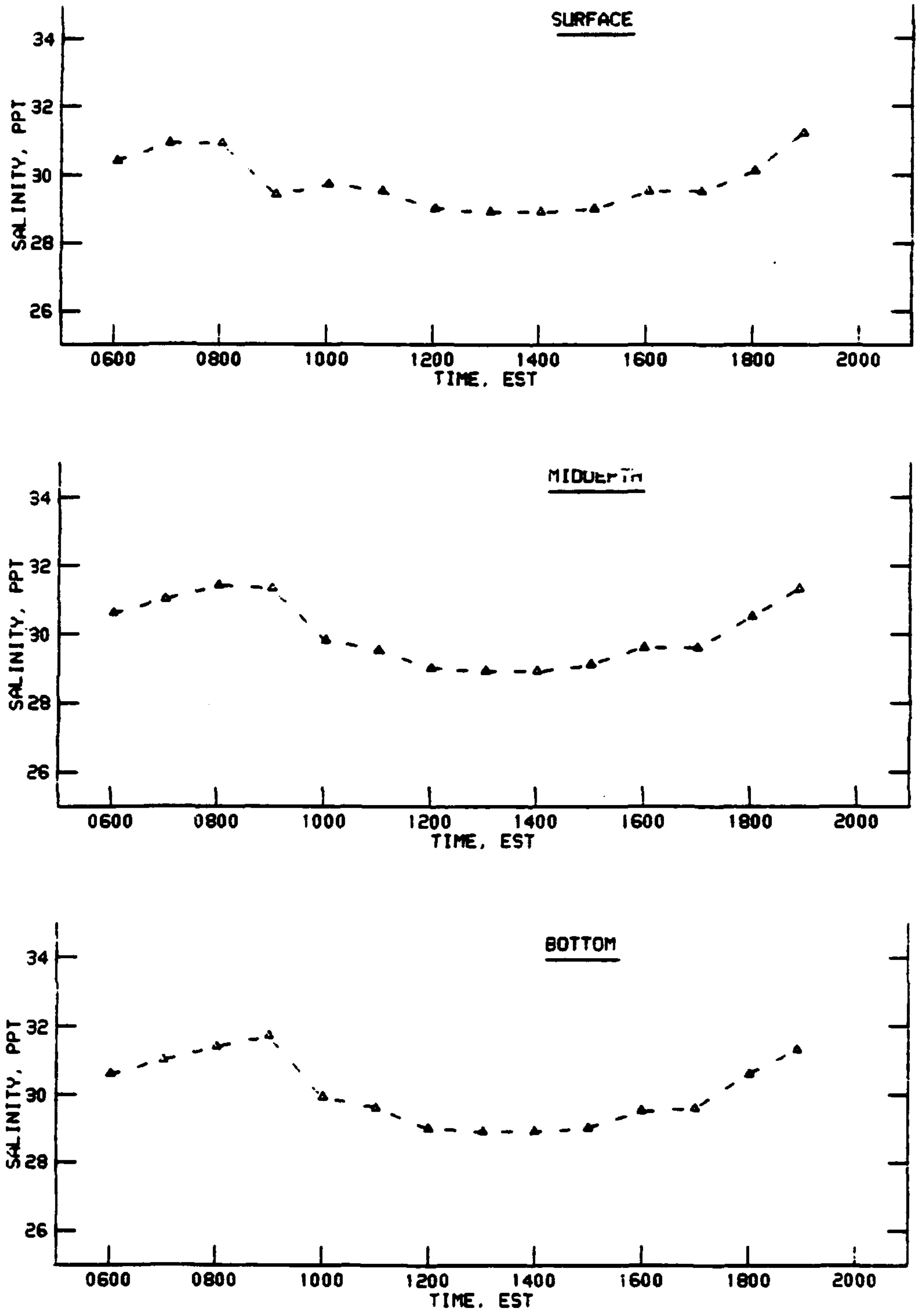
SALINITY AT STATION 4D

7 MAY 1990

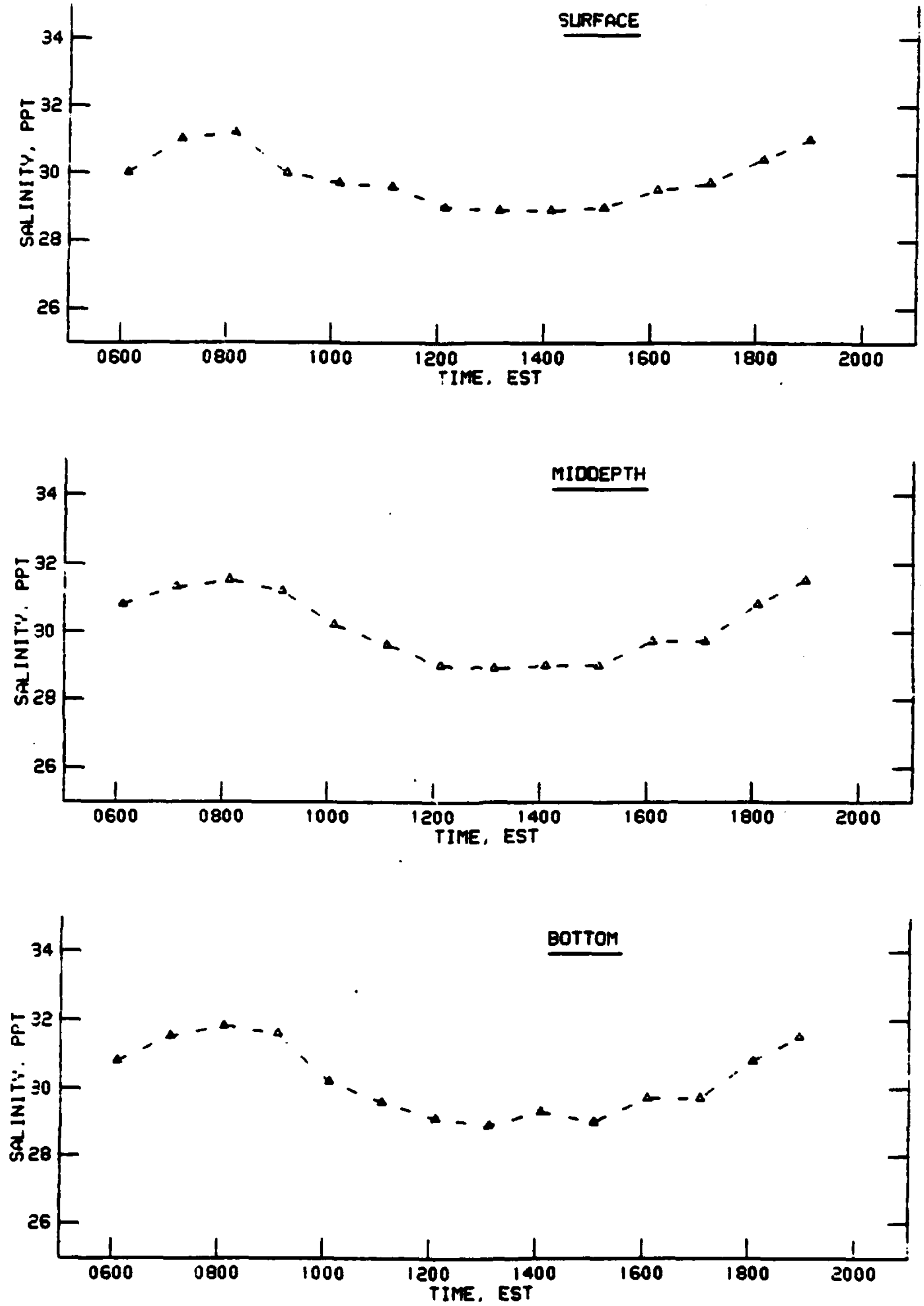
PLATE 50
(Sheet 1 of 2)



SALINITY AT STATION 4D
7 MAY 1990

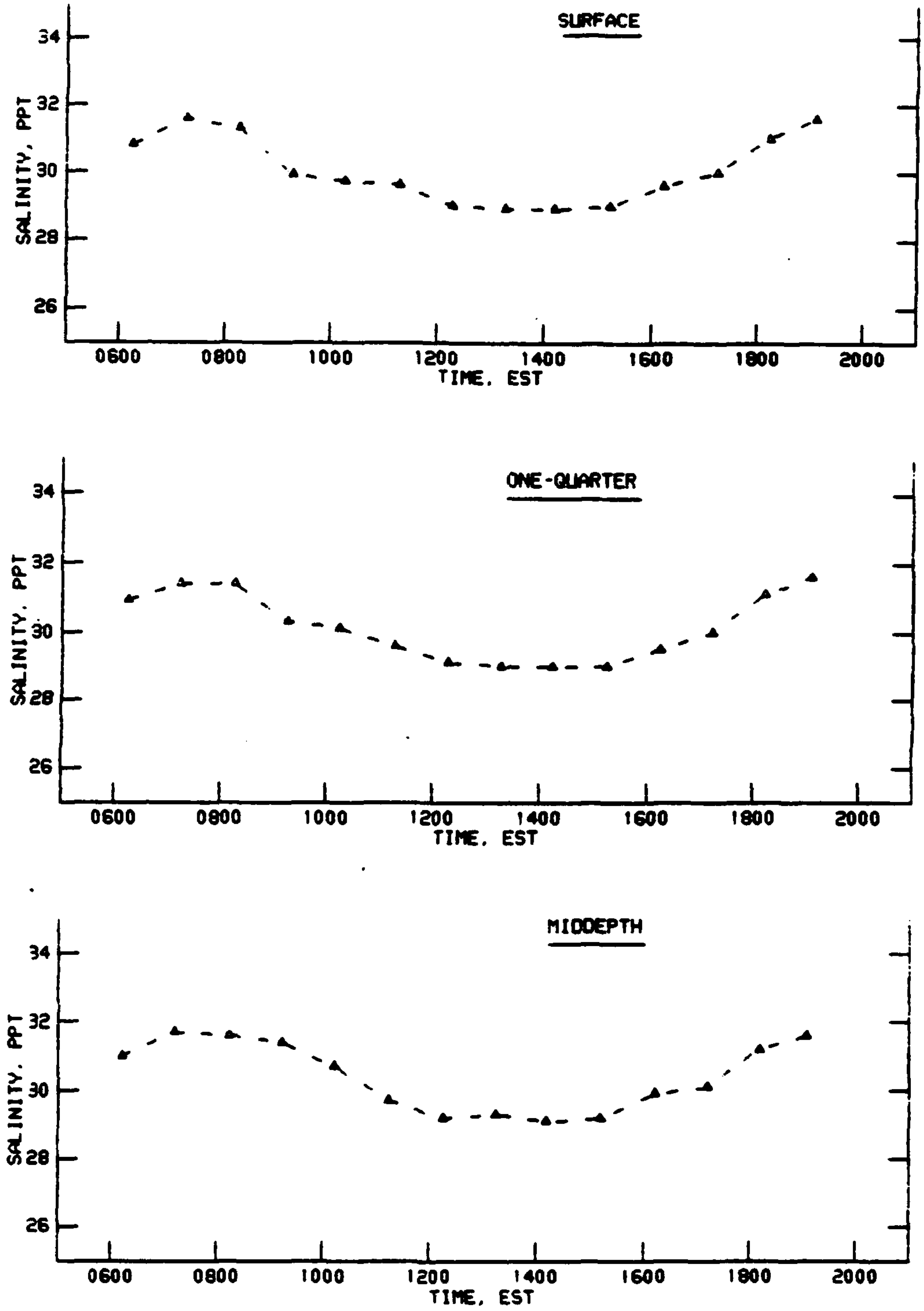


SALINITY AT STATION 4A
8 MAY 1990



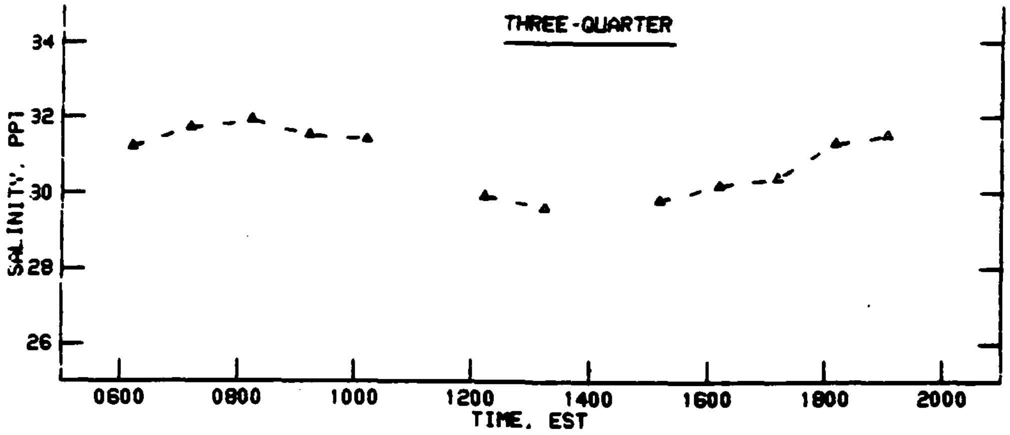
SALINITY AT STATION 4B

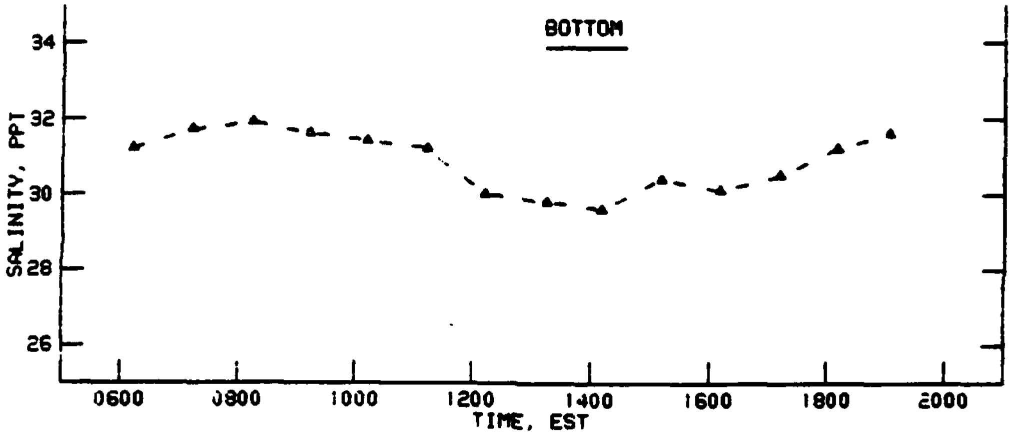
8 MAY 1990



SALINITY AT STATION 4C
8 MAY 1990

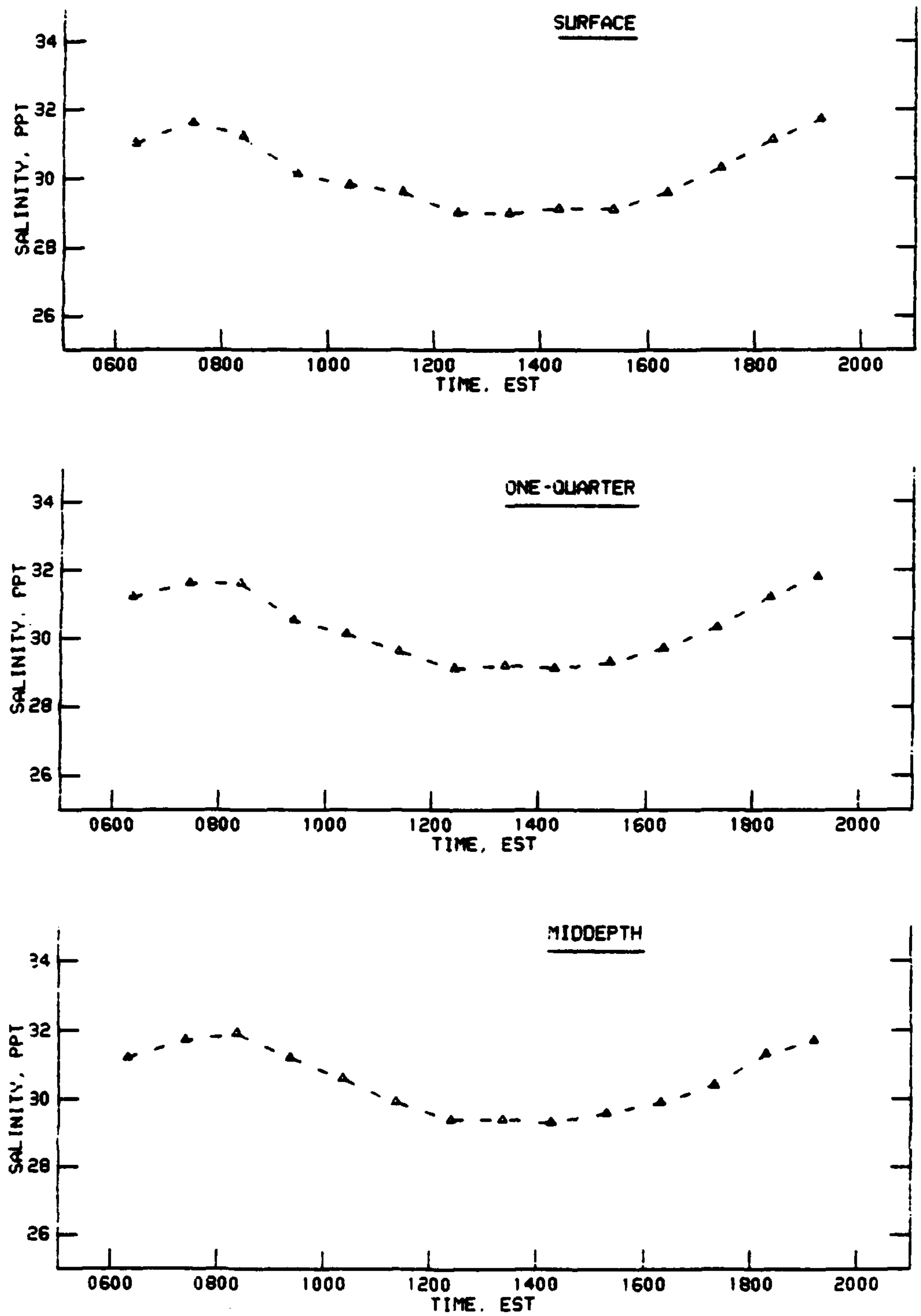
PLATE 53
(Sheet 1 of 2)





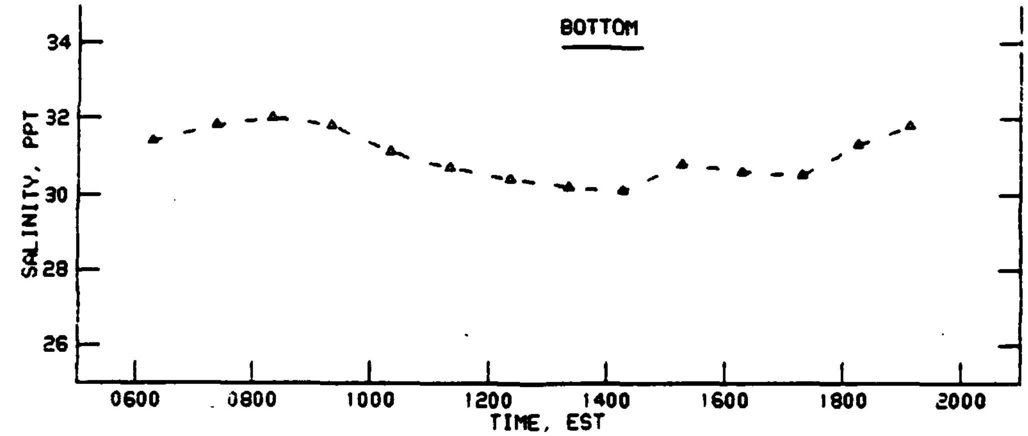
SALINITY AT STATION 4C

8 MAY 1990



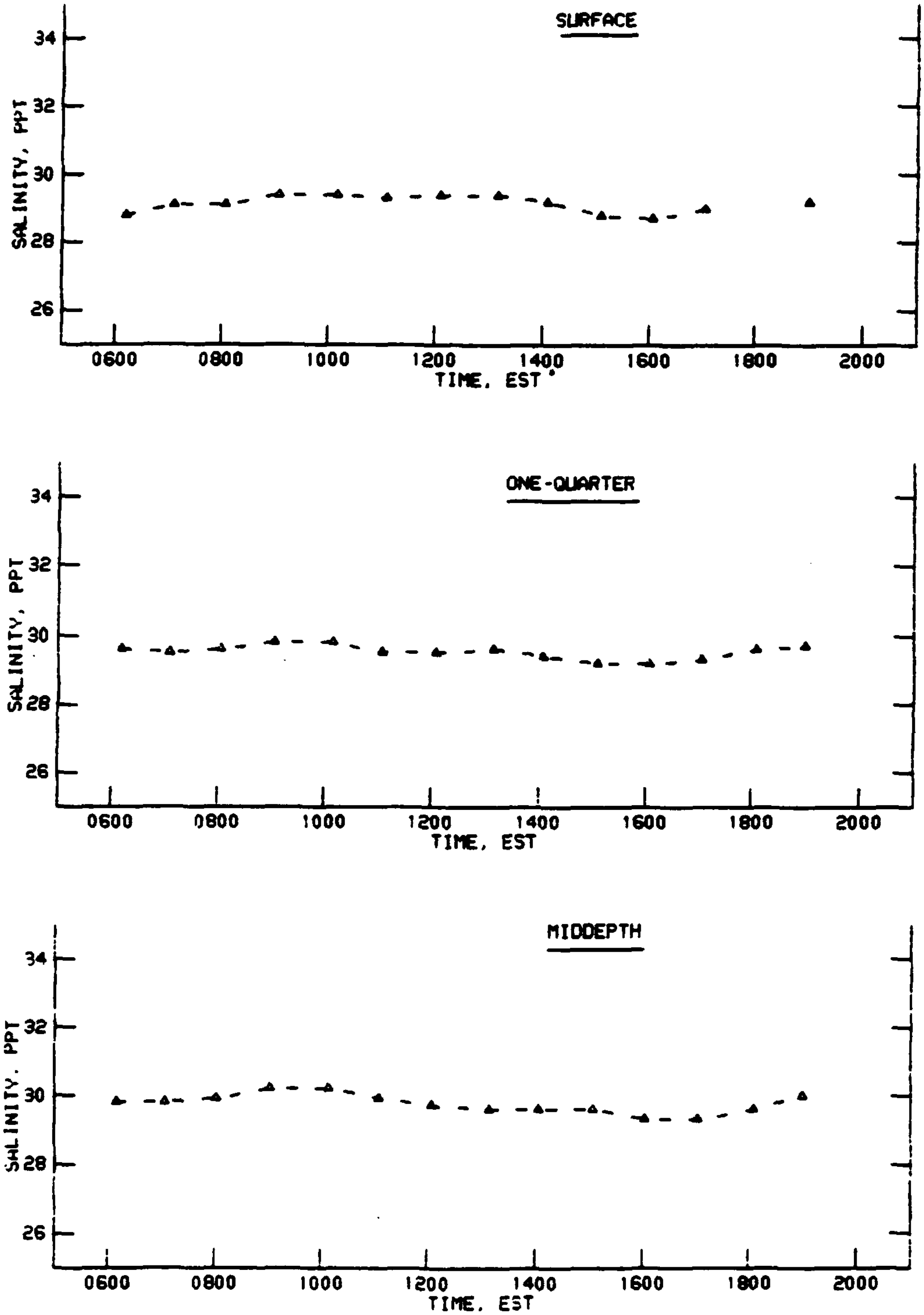
SALINITY AT STATION 4D
8 MAY 1990

PLATE 54
(Sheet 1 of 2)



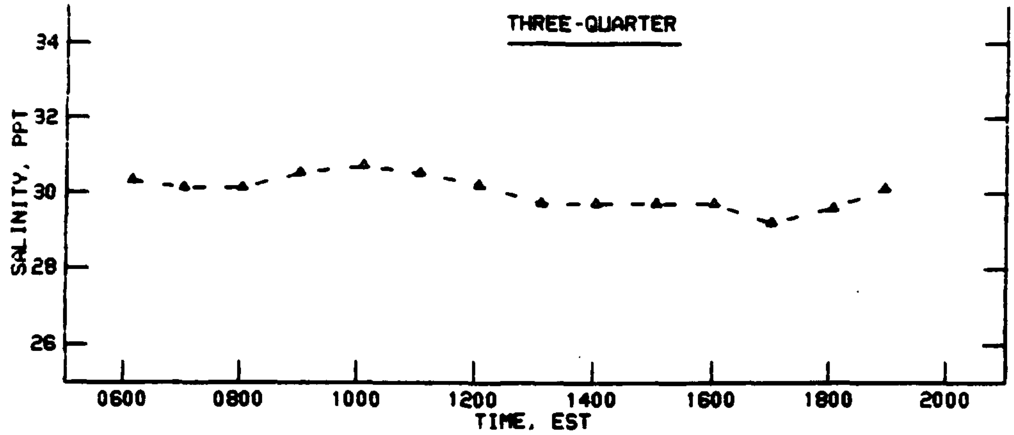
SALINITY AT STATION 4D

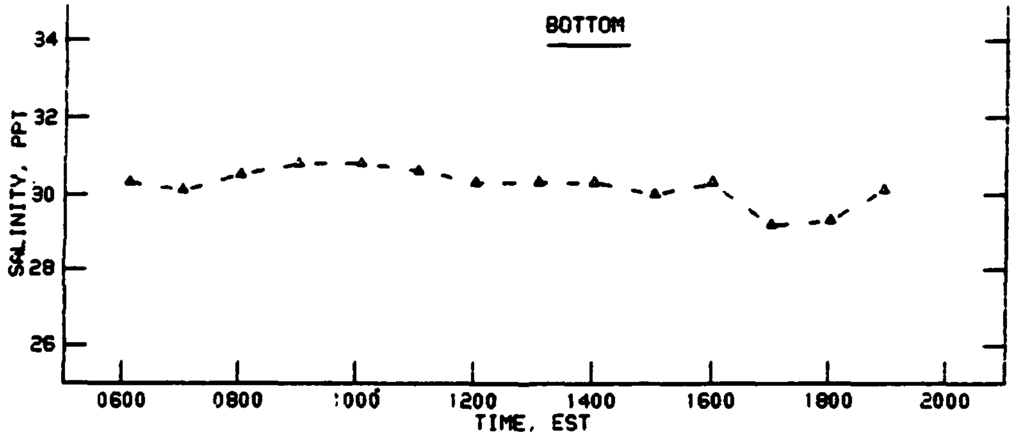
8 MAY 1990



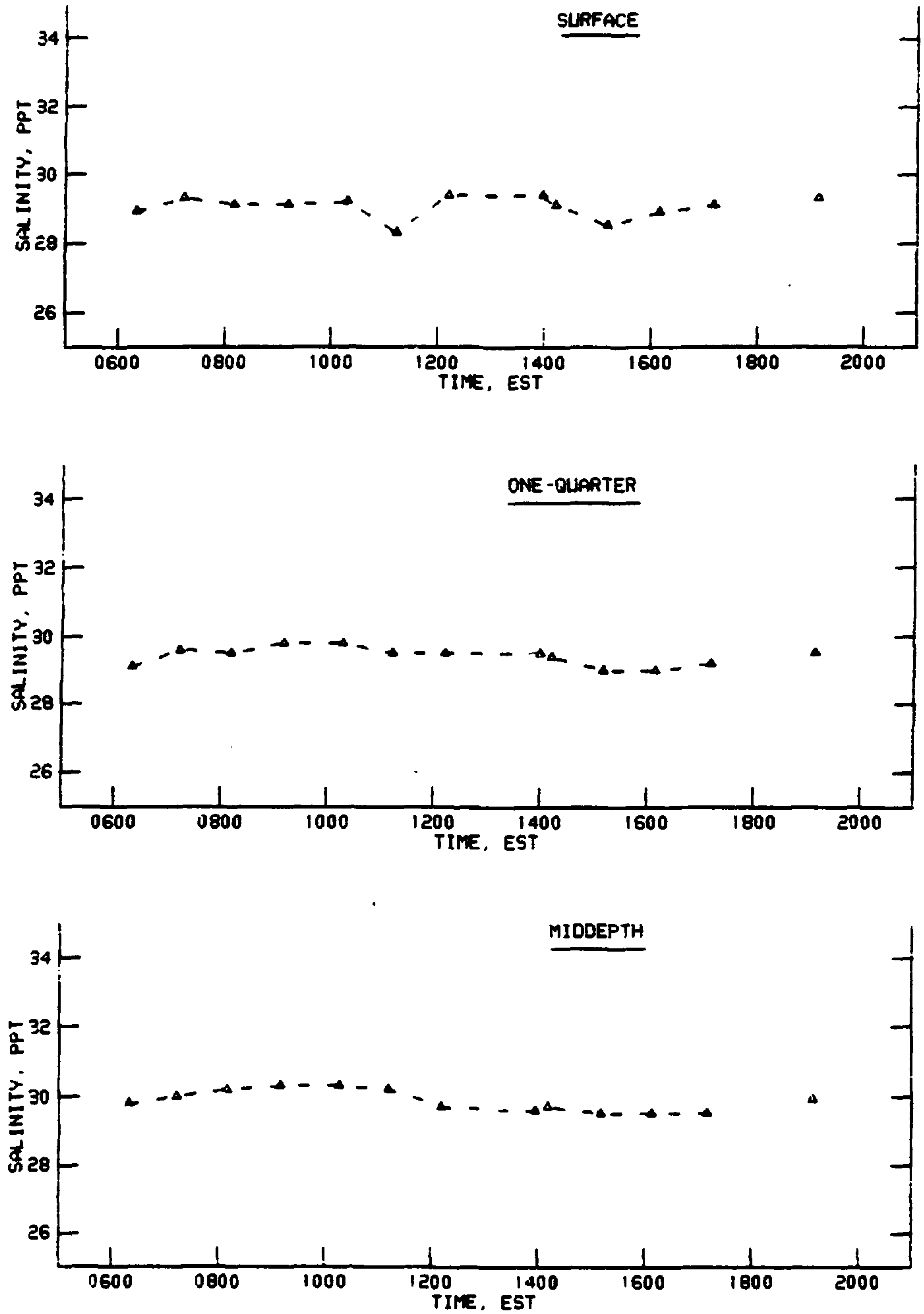
SALINITY AT STATION 5A
8 MAY 1990

PLATE 55
(Sheet 1 of 2)



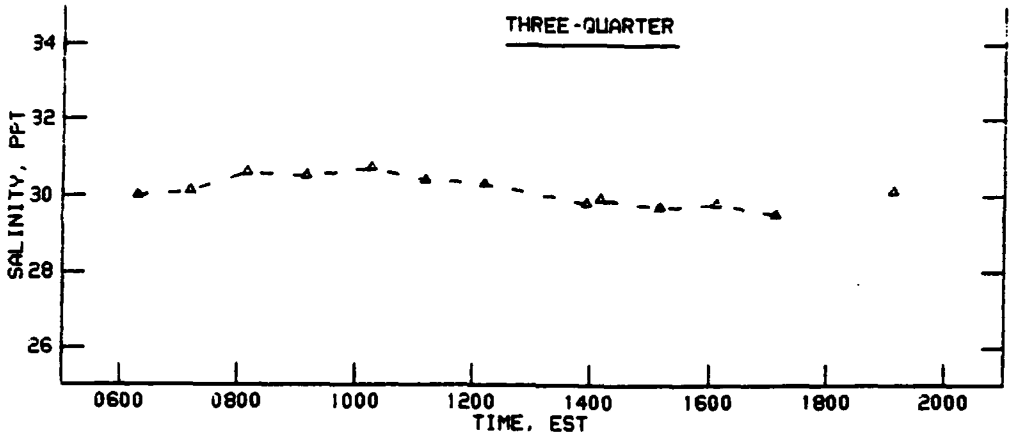


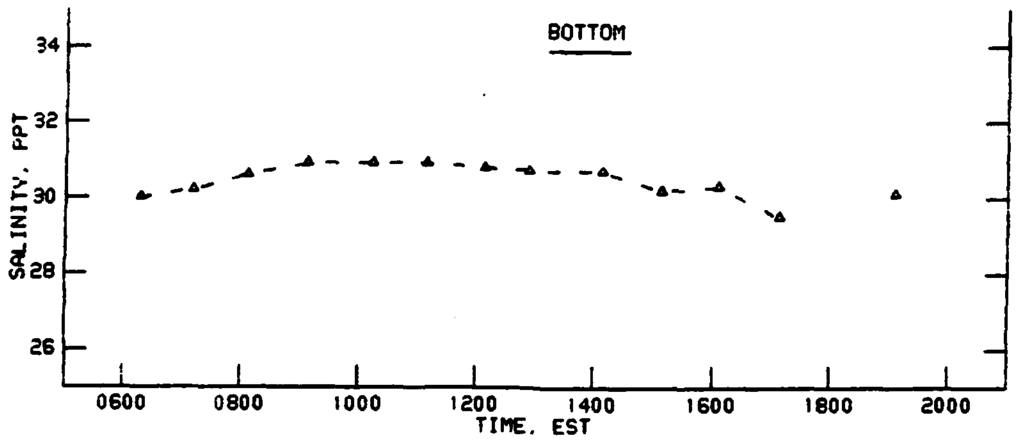
SALINITY AT STATION 5A
8 MAY 1990



SALINITY AT STATION 5B
8 MAY 1990

PLATE 56
(Sheet 1 of 2)

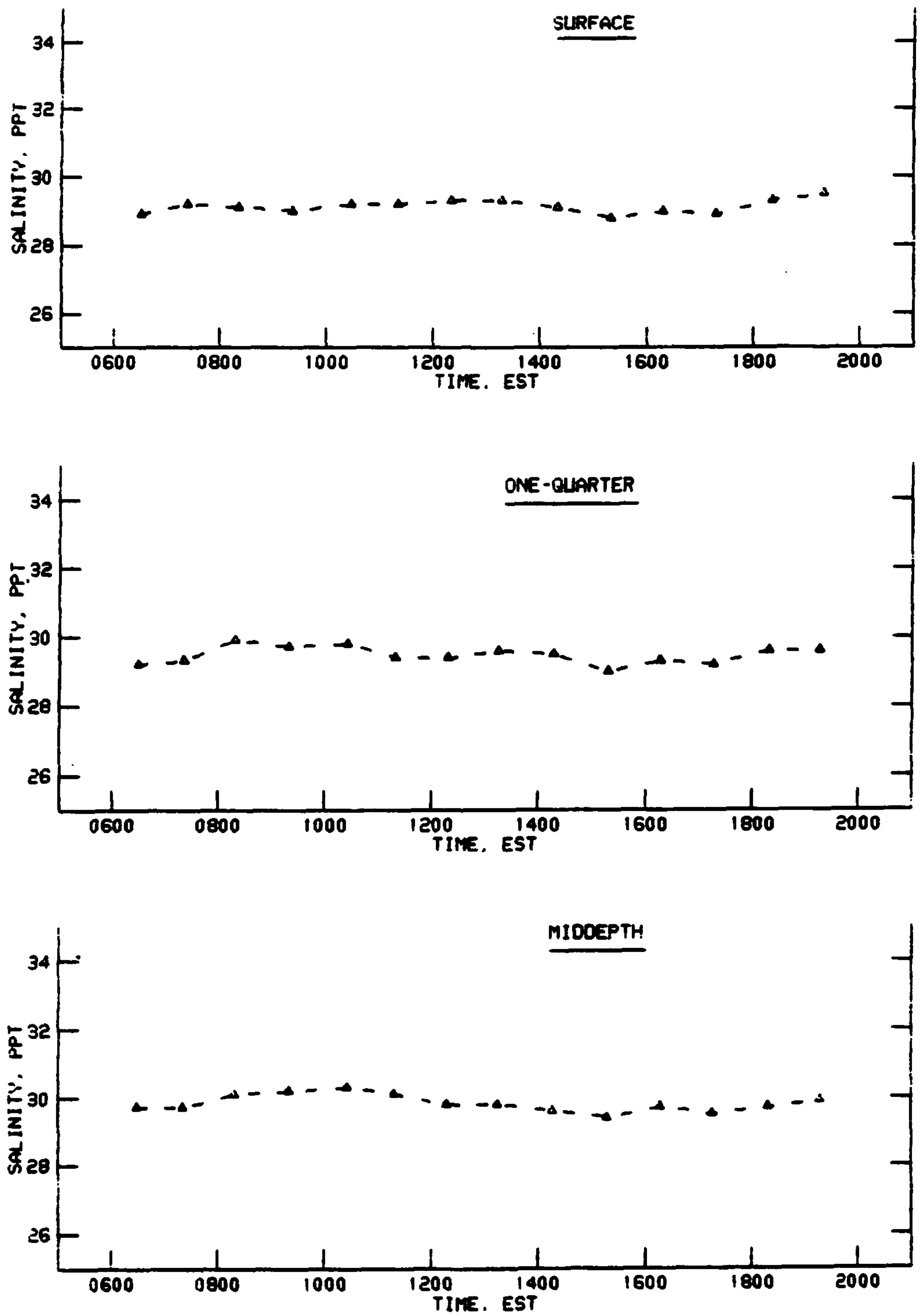




SALINITY AT STATION 5B

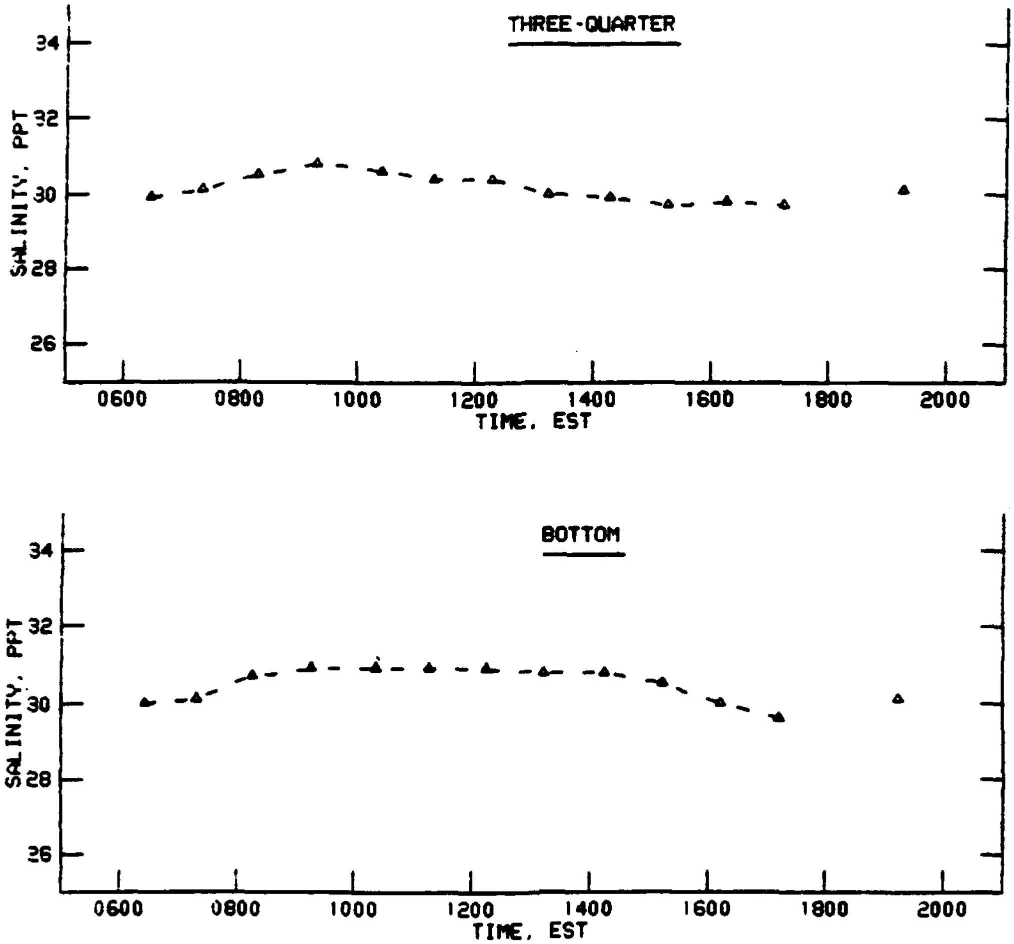
8 MAY 1990

PLATE 56
(Sheet 2 of 2)



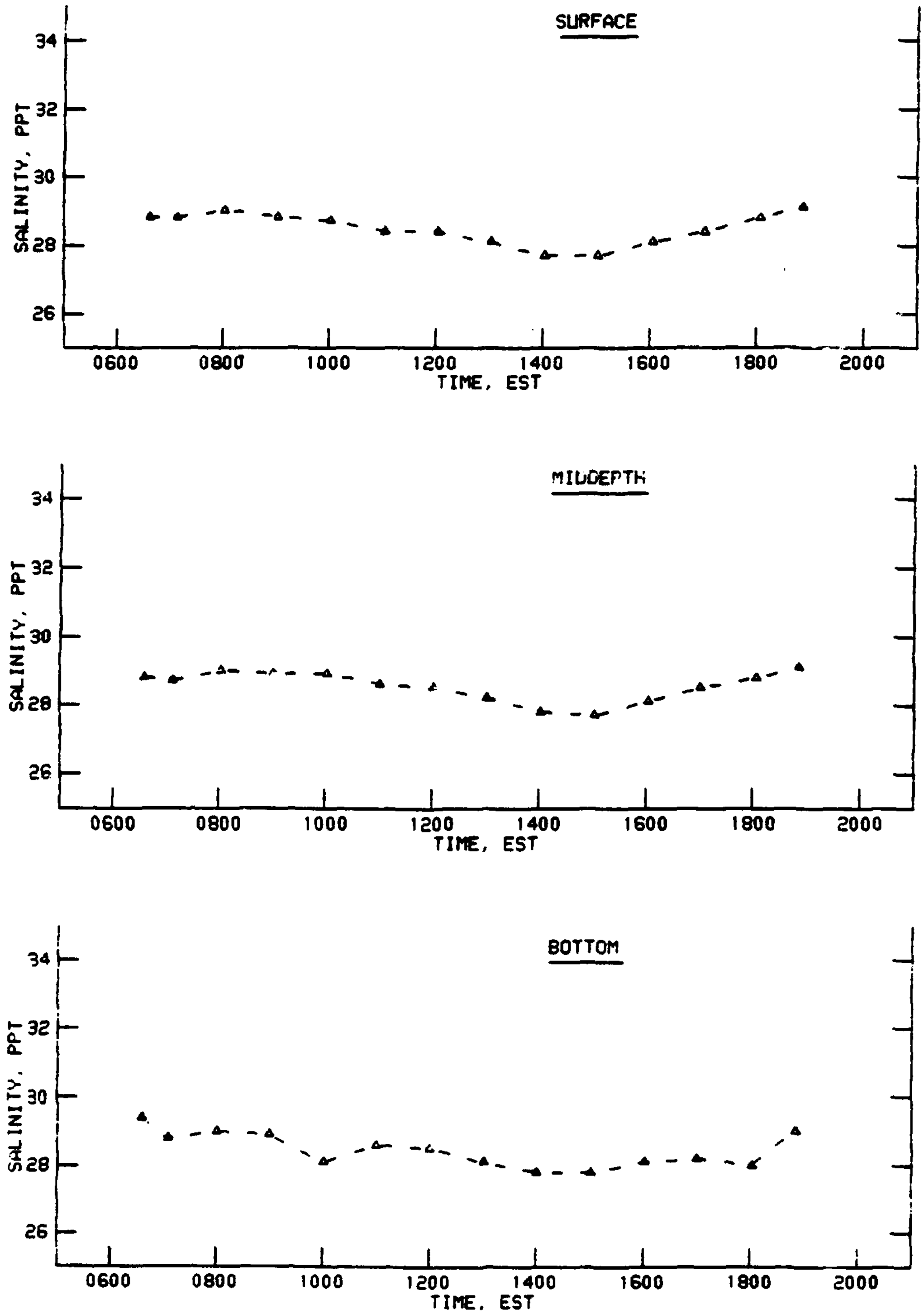
SALINITY AT STATION 5C
8 MAY 1990

PLATE 57
(Sheet 1 of 2)

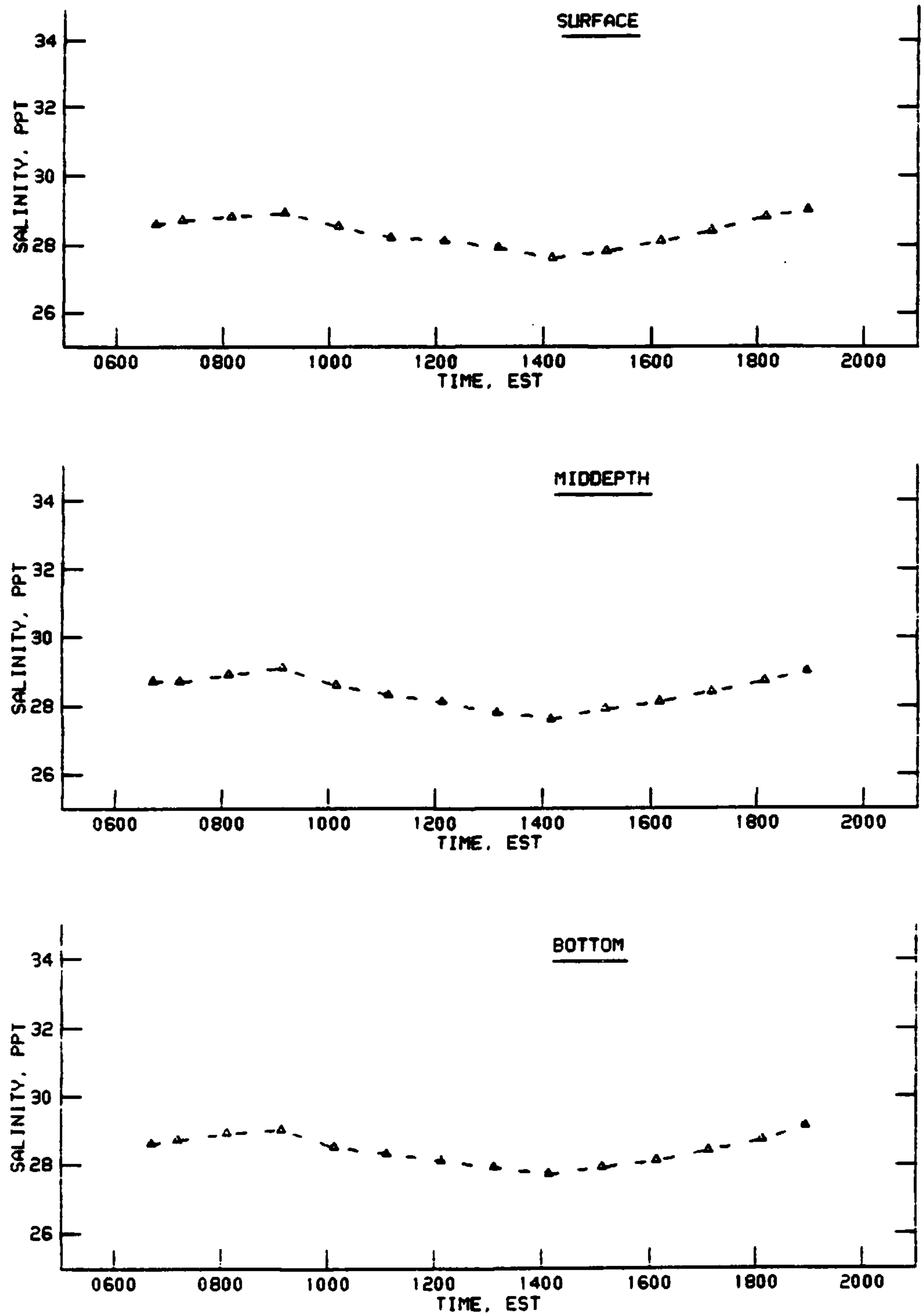


SALINITY AT STATION 5C

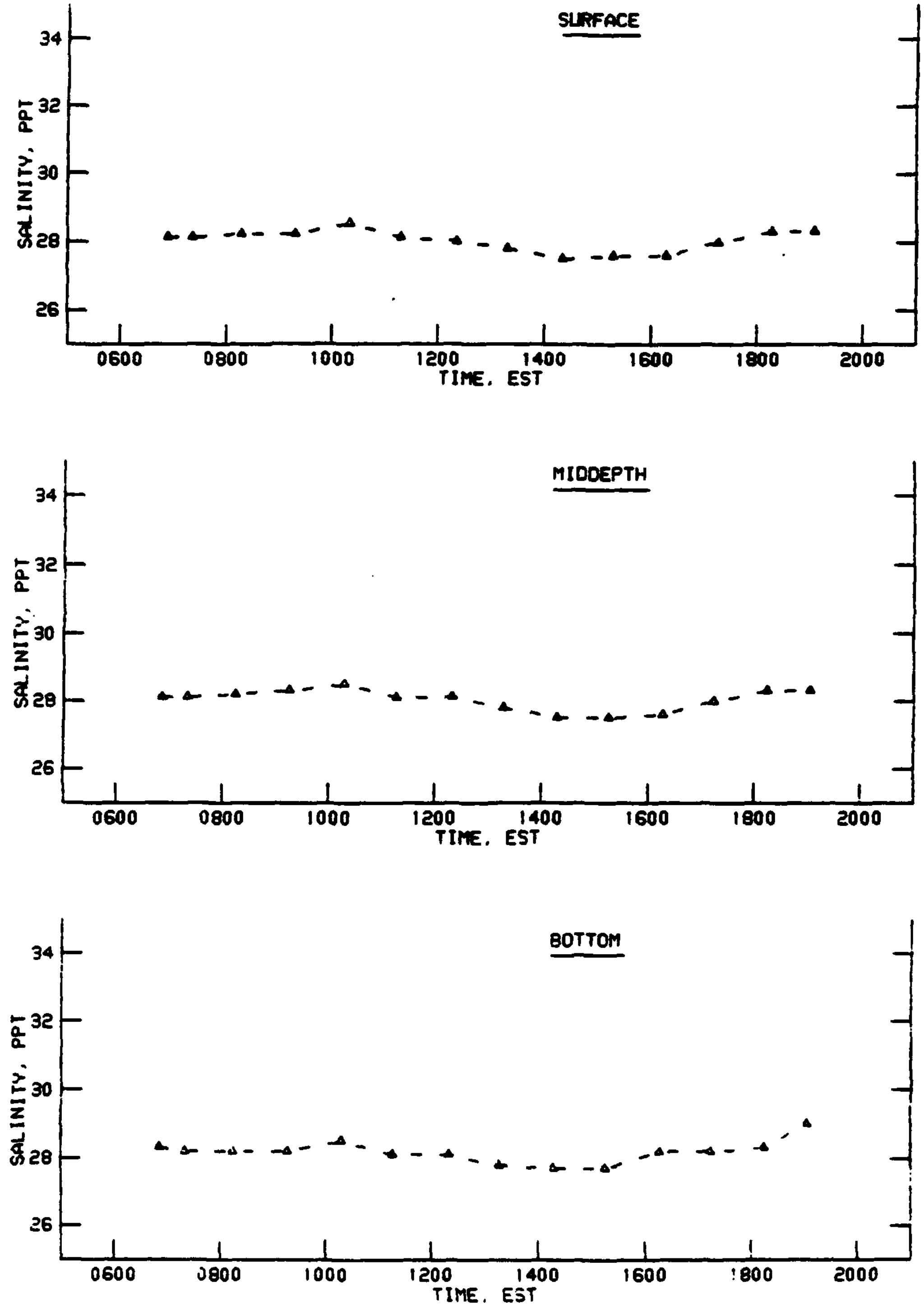
8 MAY 1990



SALINITY AT STATION 7A
8 MAY 1990

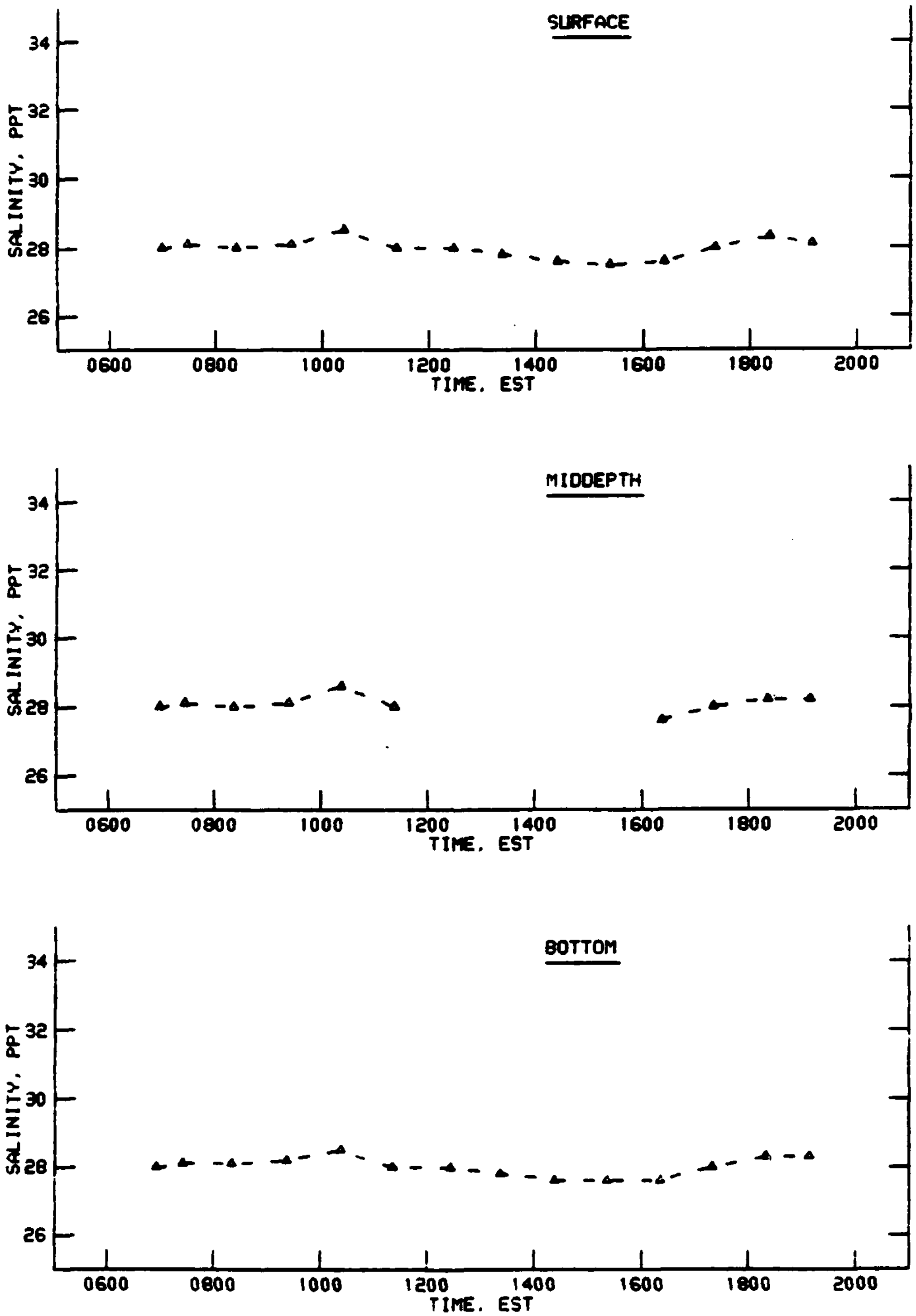


SALINITY AT STATION 7B
8 MAY 1990



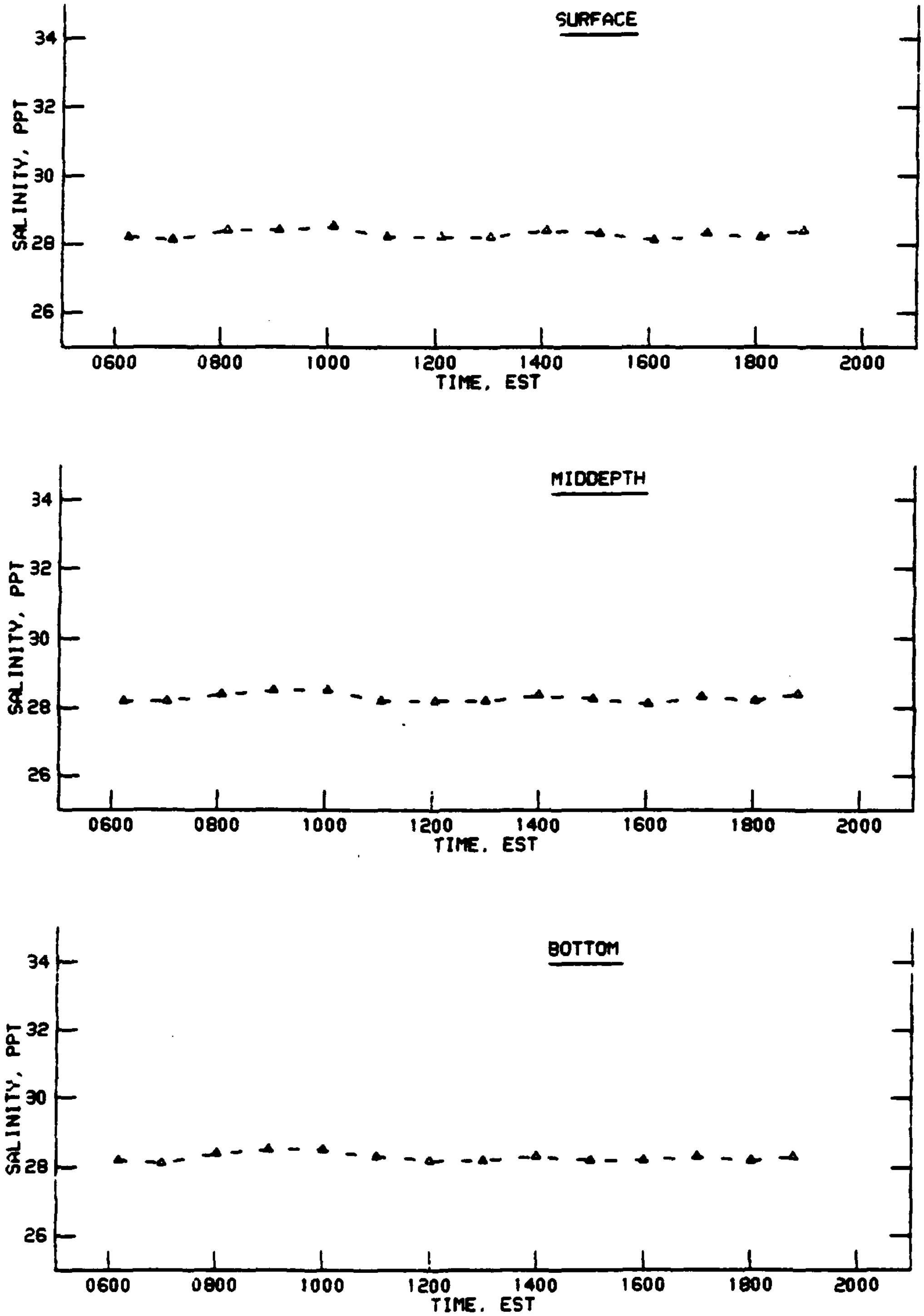
SALINITY AT STATION 7C
8 MAY 1990

PLATE 60

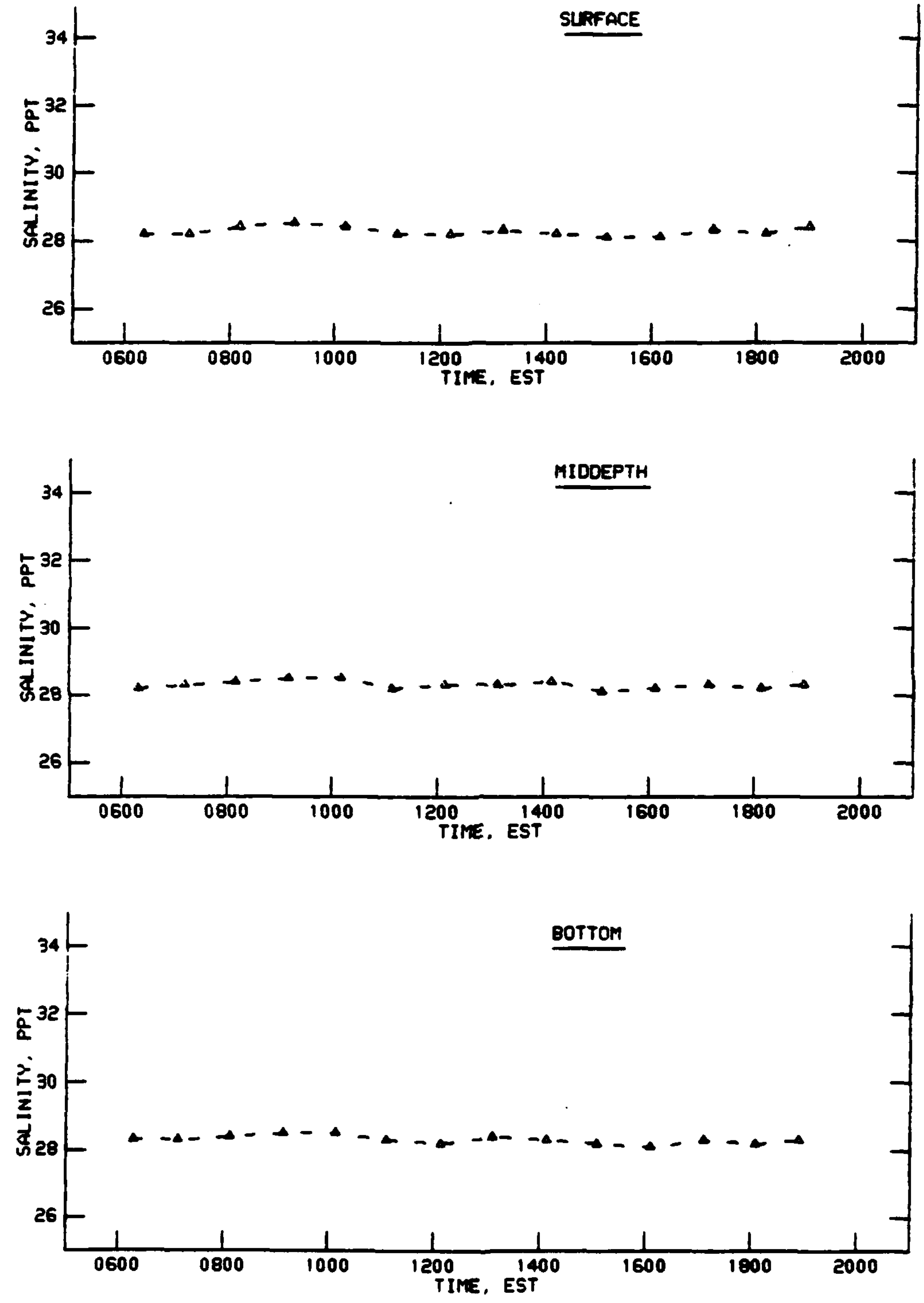


SALINITY AT STATION 7D

8 MAY 1990

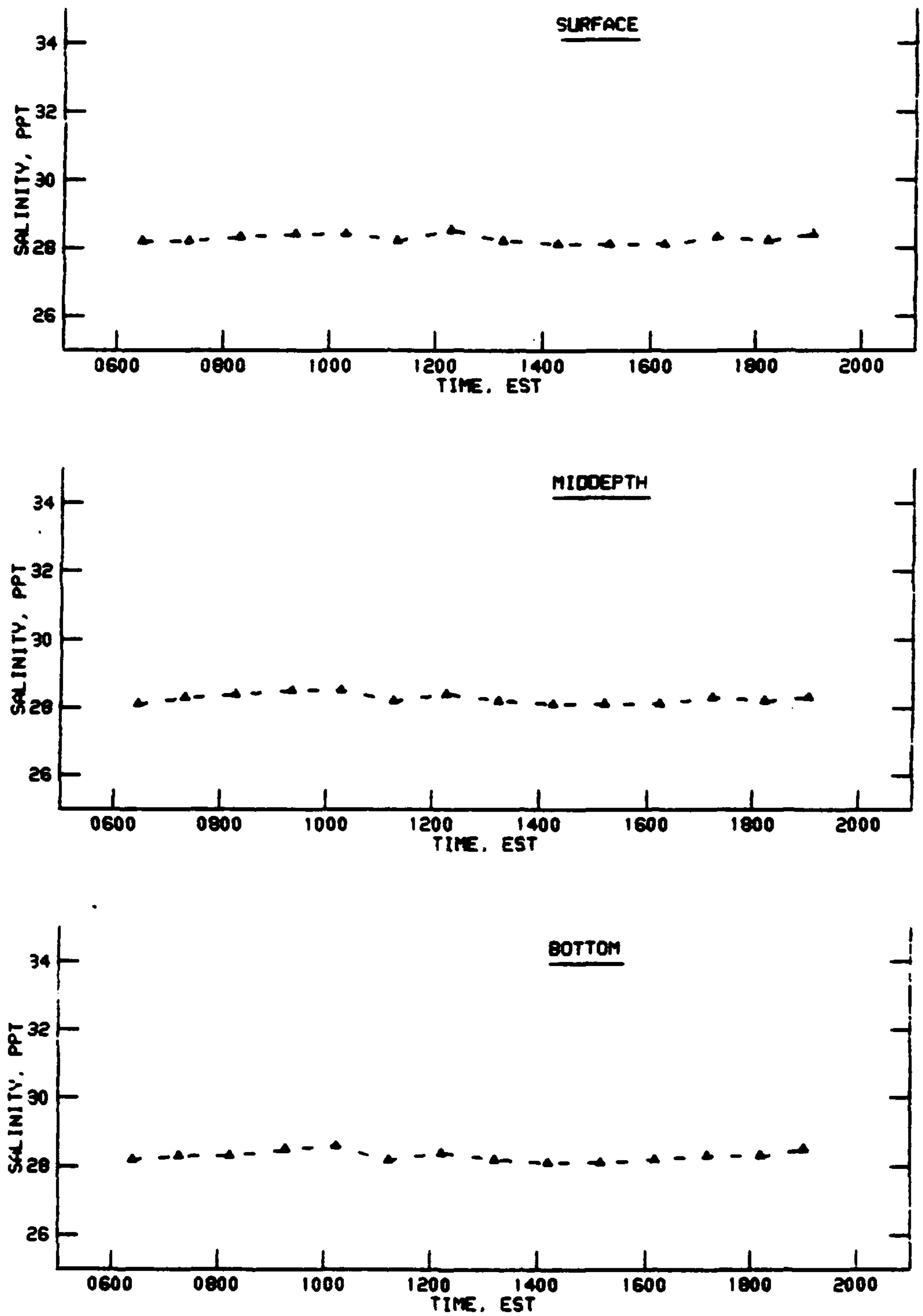


SALINITY AT STATION 8A
8 MAY 1990



SALINITY AT STATION 8B

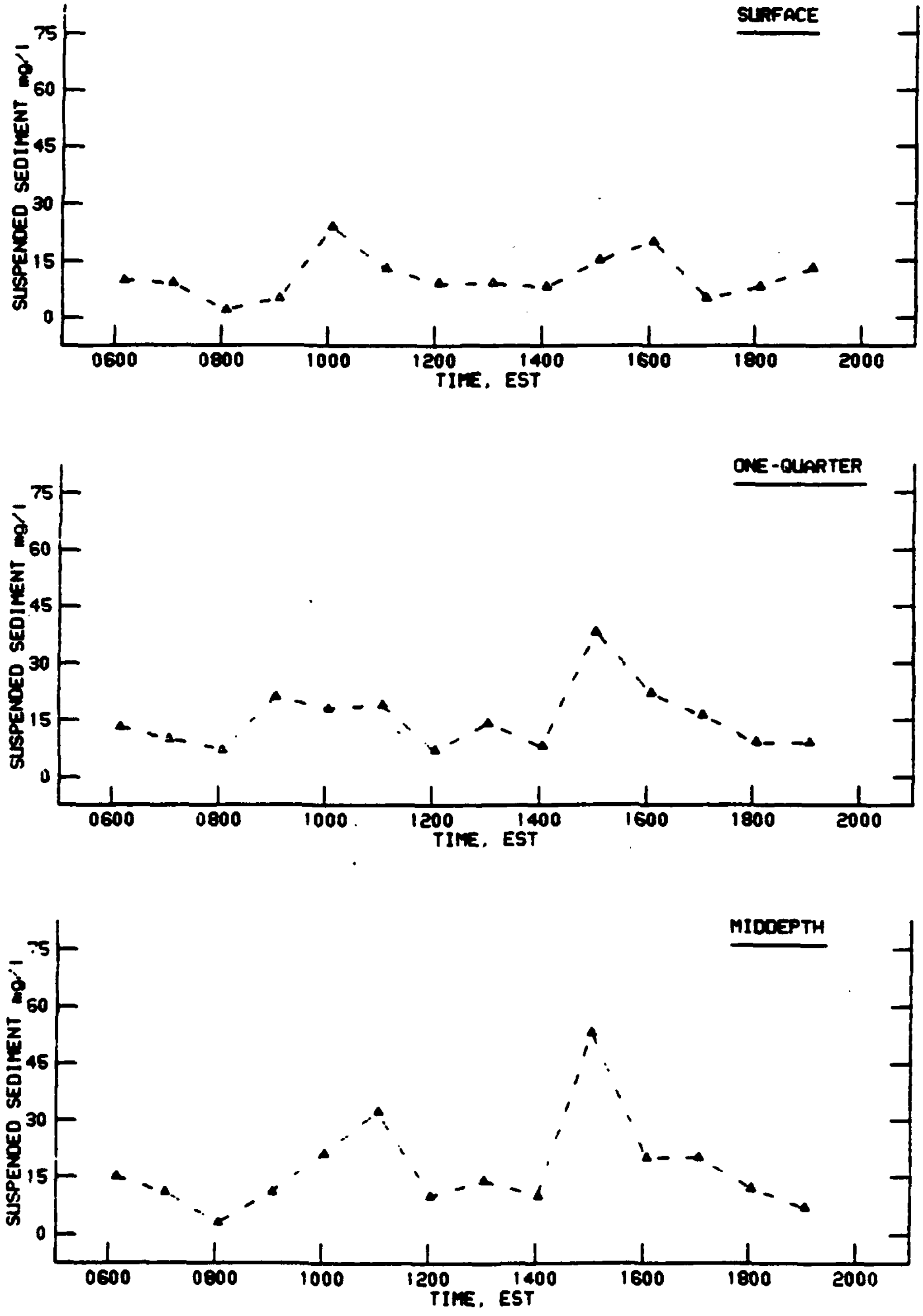
8 MAY 1990



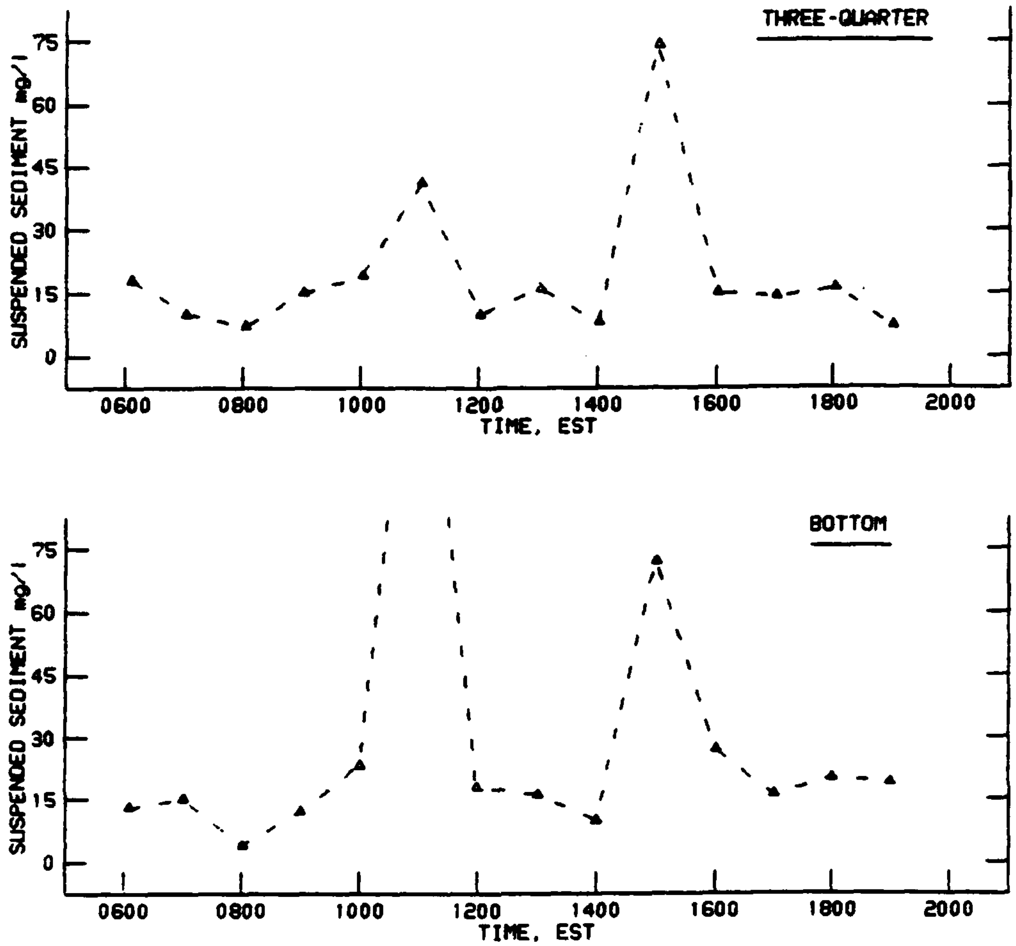
SALINITY AT STATION 8C

8 MAY 1990

PLATE 64

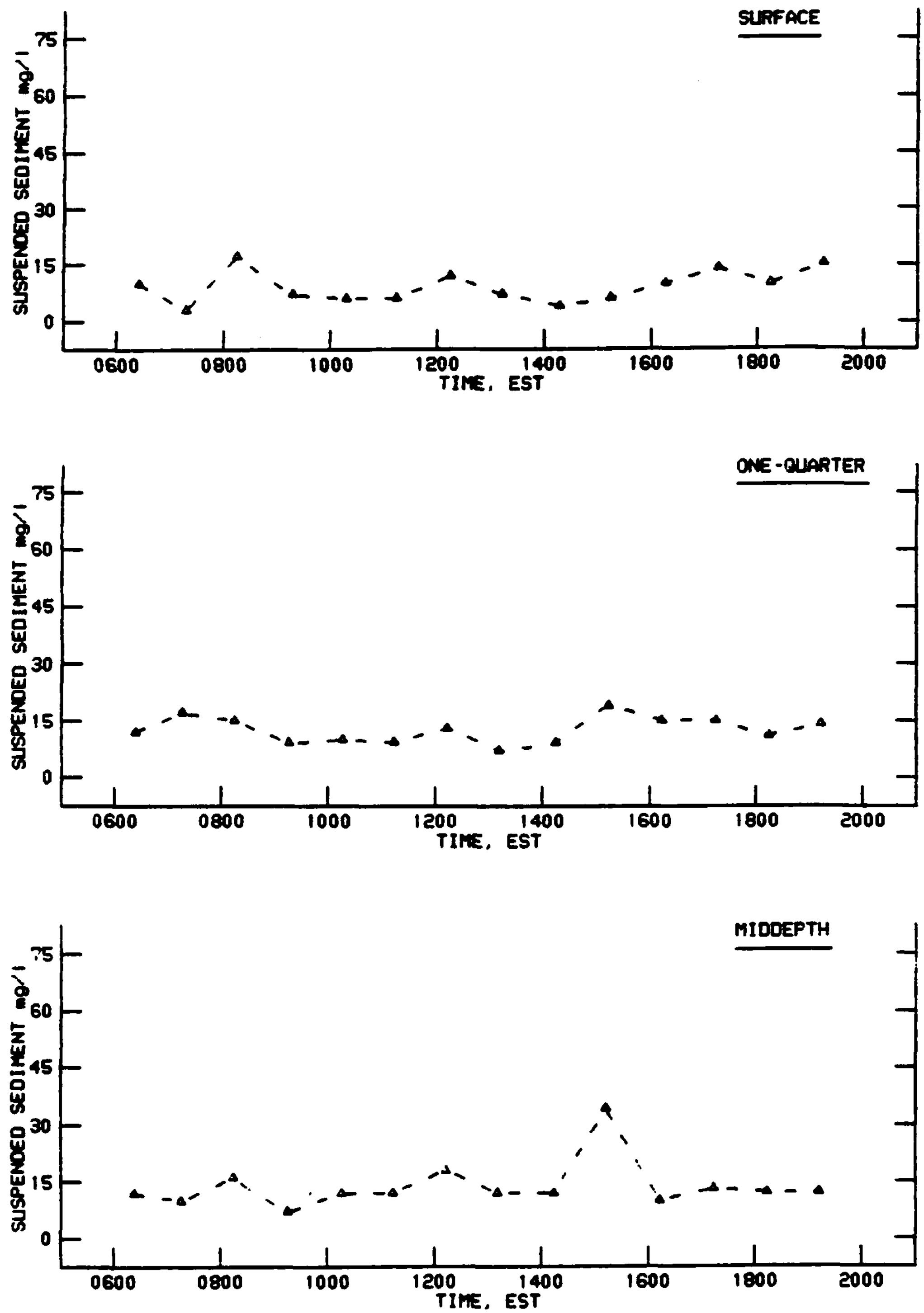


SUSPENDED SEDIMENT AT STATION 1A
7 MAY 1990



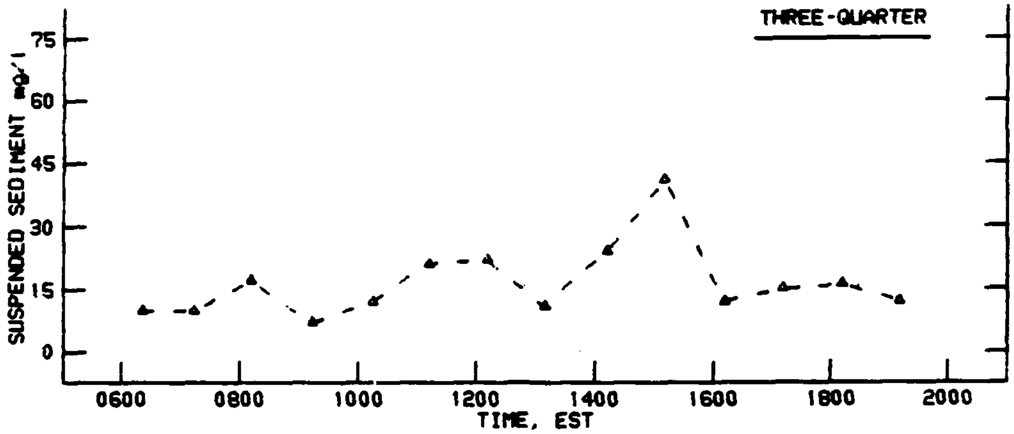
SUSPENDED SEDIMENT AT STATION 1A
7 MAY 1990

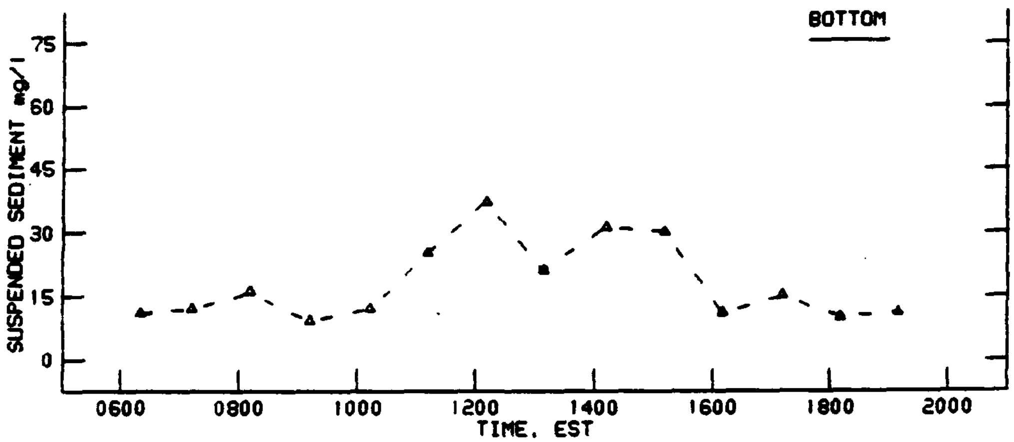
PLATE 65
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 1B

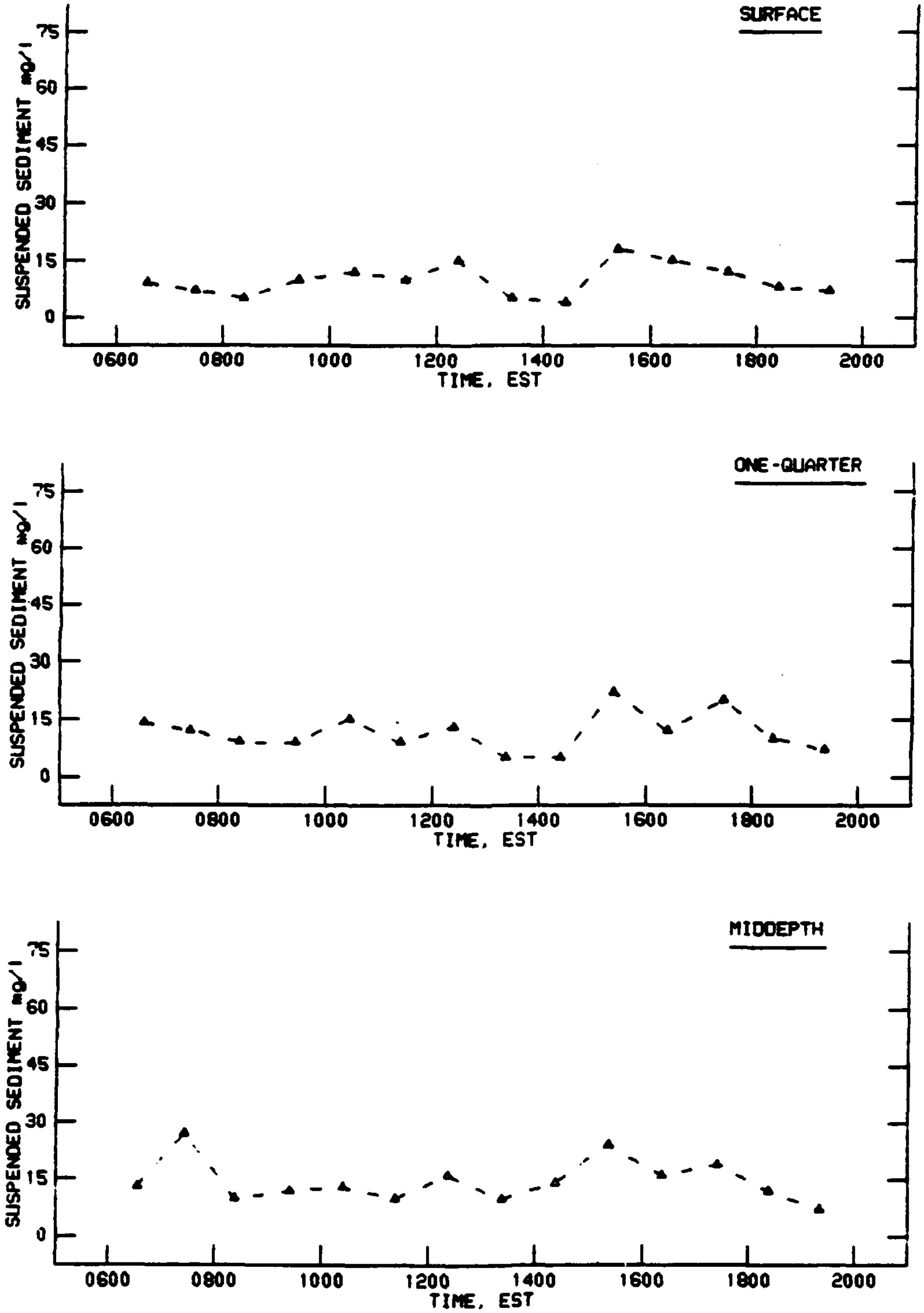
7 MAY 1990





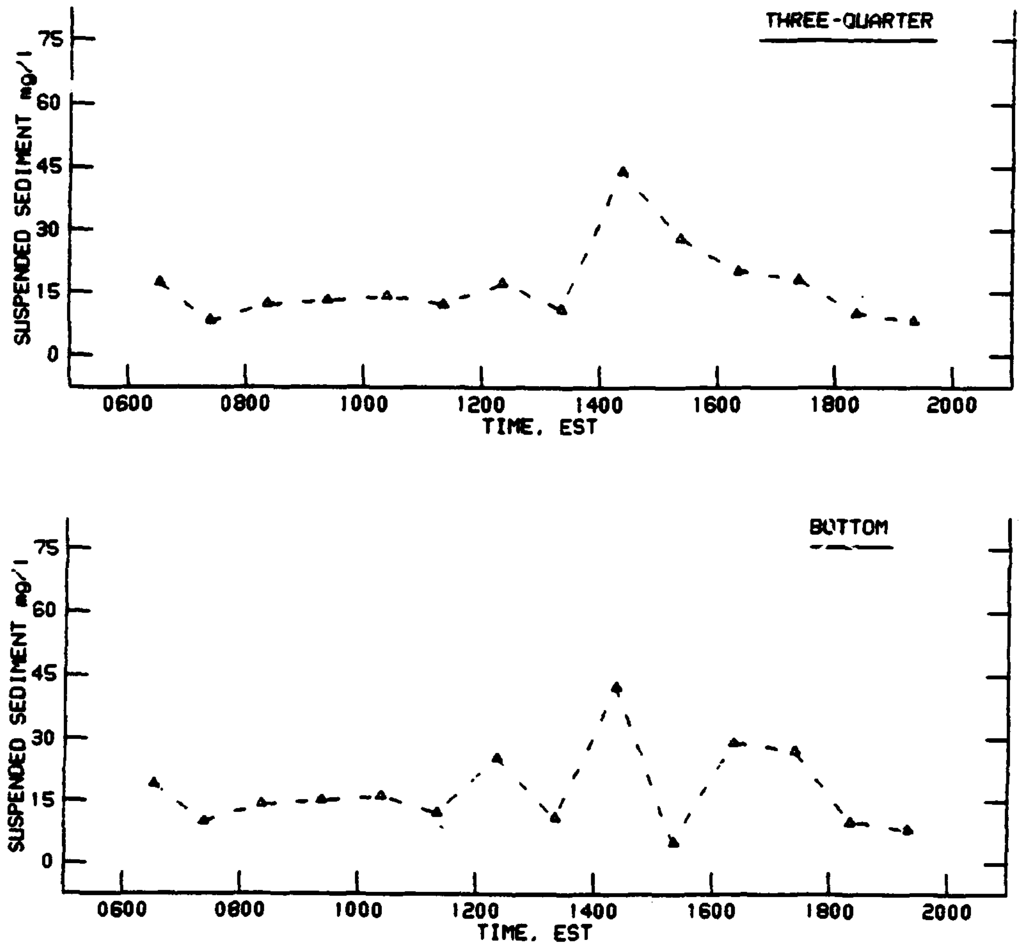
SUSPENDED SEDIMENT AT STATION 1B

7 MAY 1990



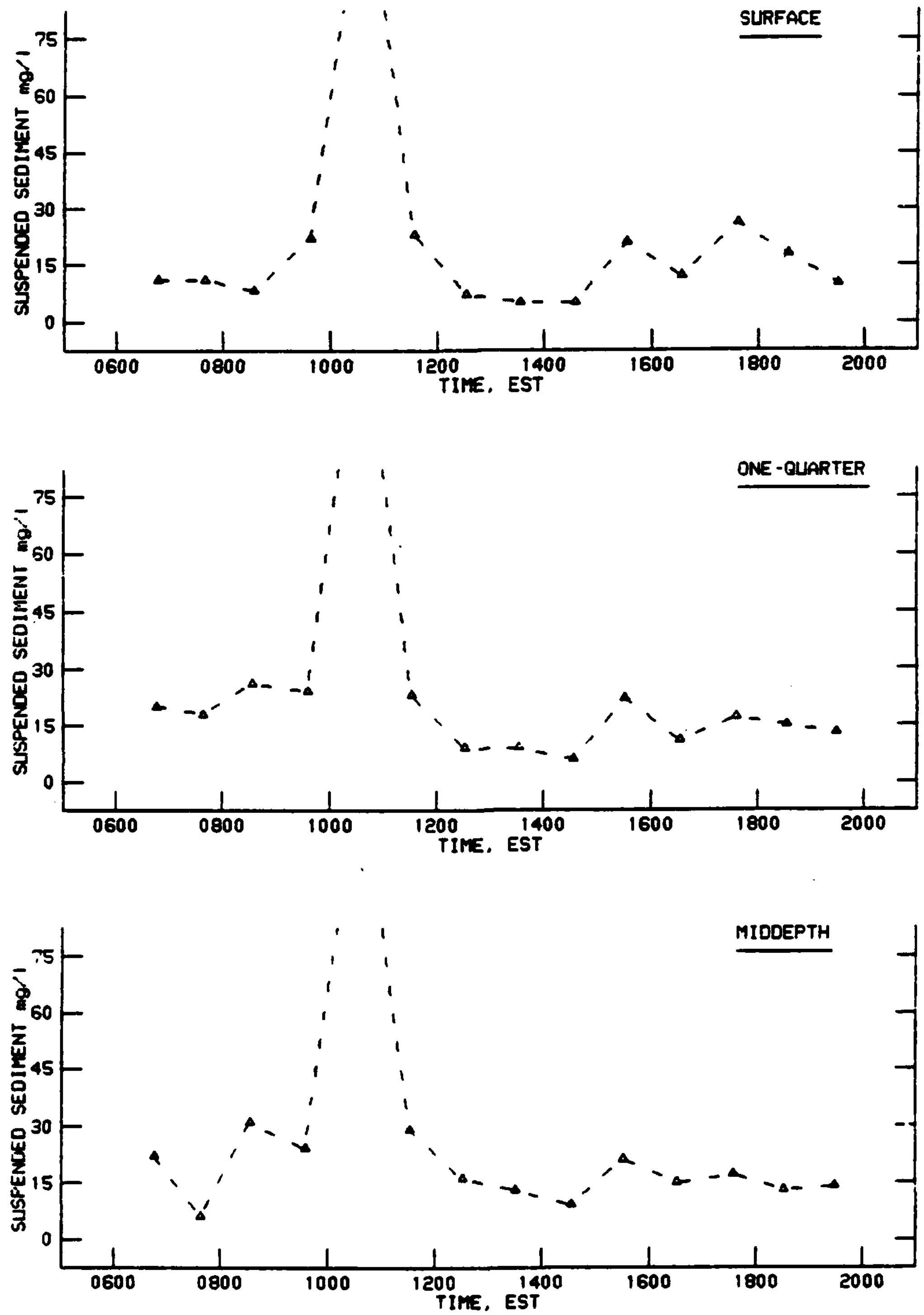
SUSPENDED SEDIMENT AT STATION 1C

7 MAY 1990

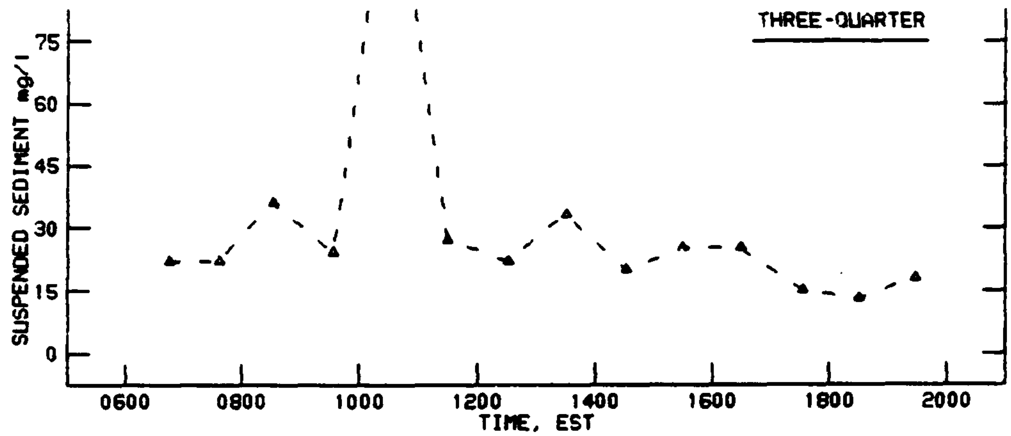


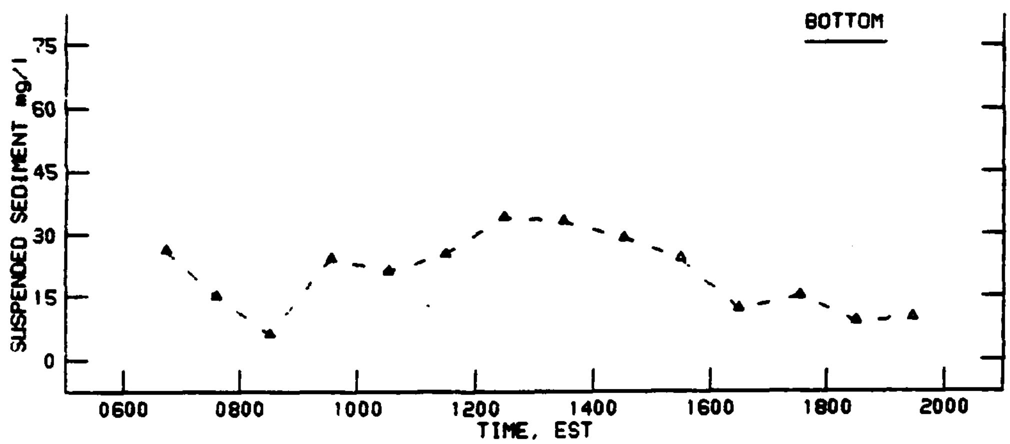
SUSPENDED SEDIMENT AT STATION 1C
7 MAY 1990

PLATE 67
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 1D
7 MAY 1990

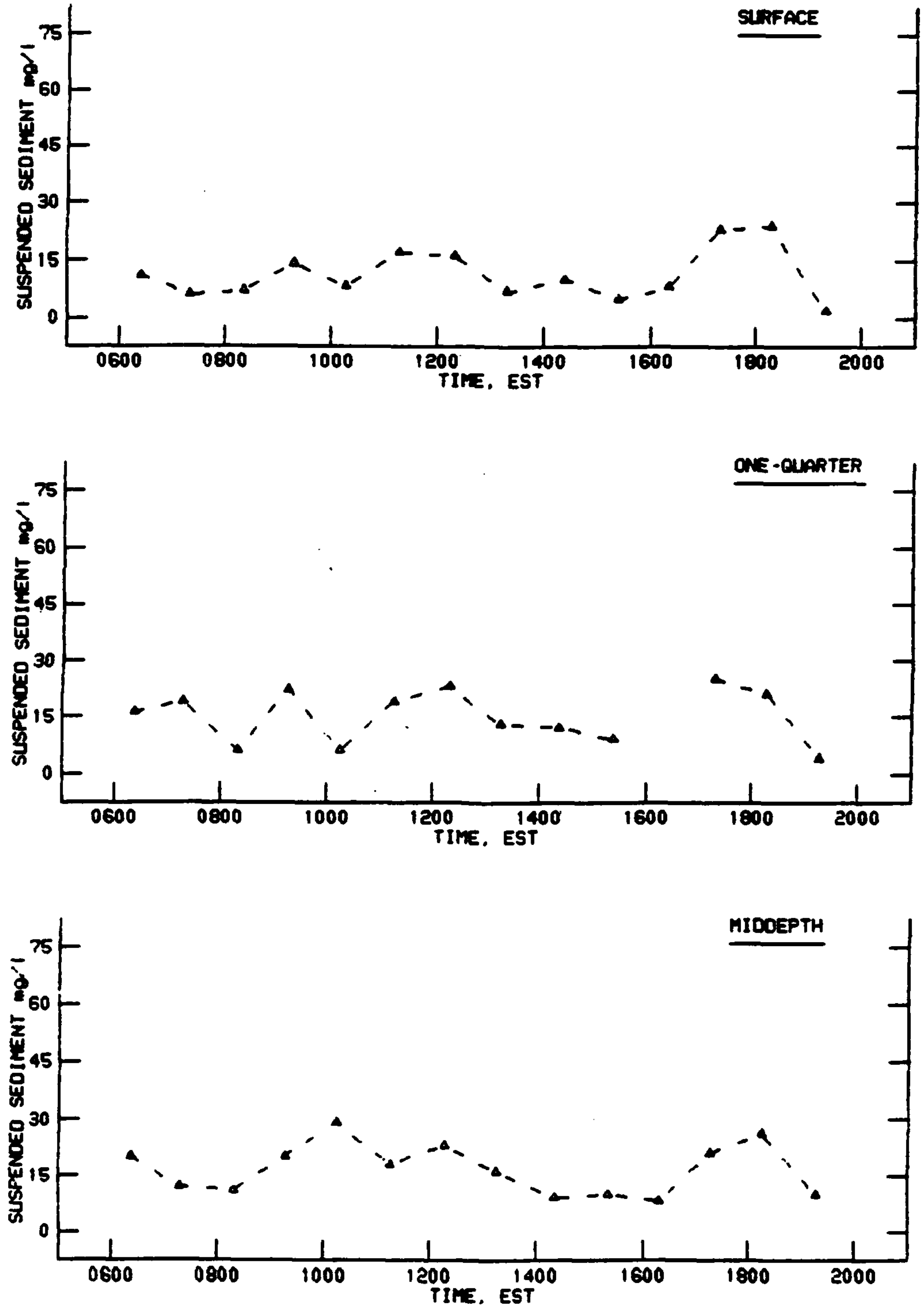




SUSPENDED SEDIMENT AT STATION 1D

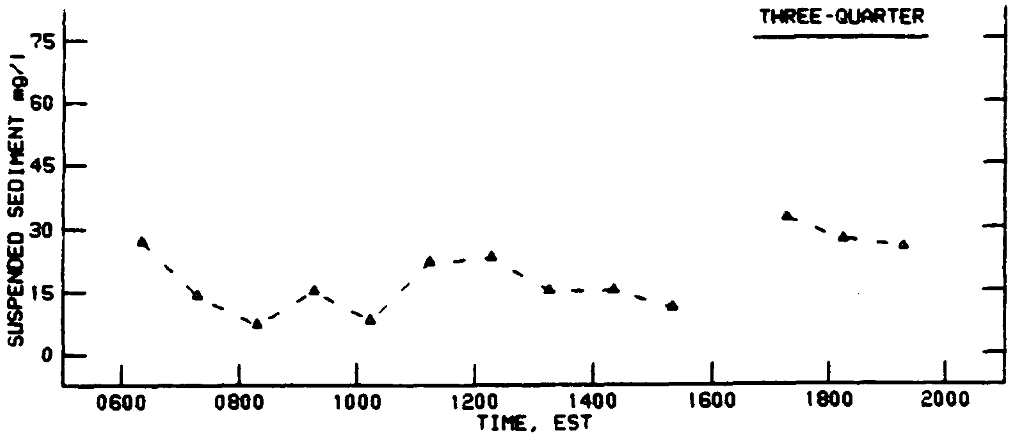
7 MAY 1990

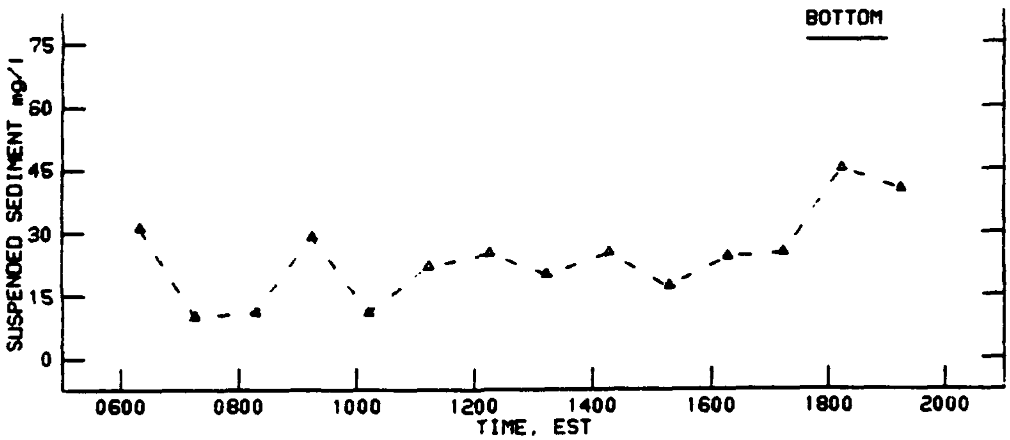
PLATE 68
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 2A

7 MAY 1990

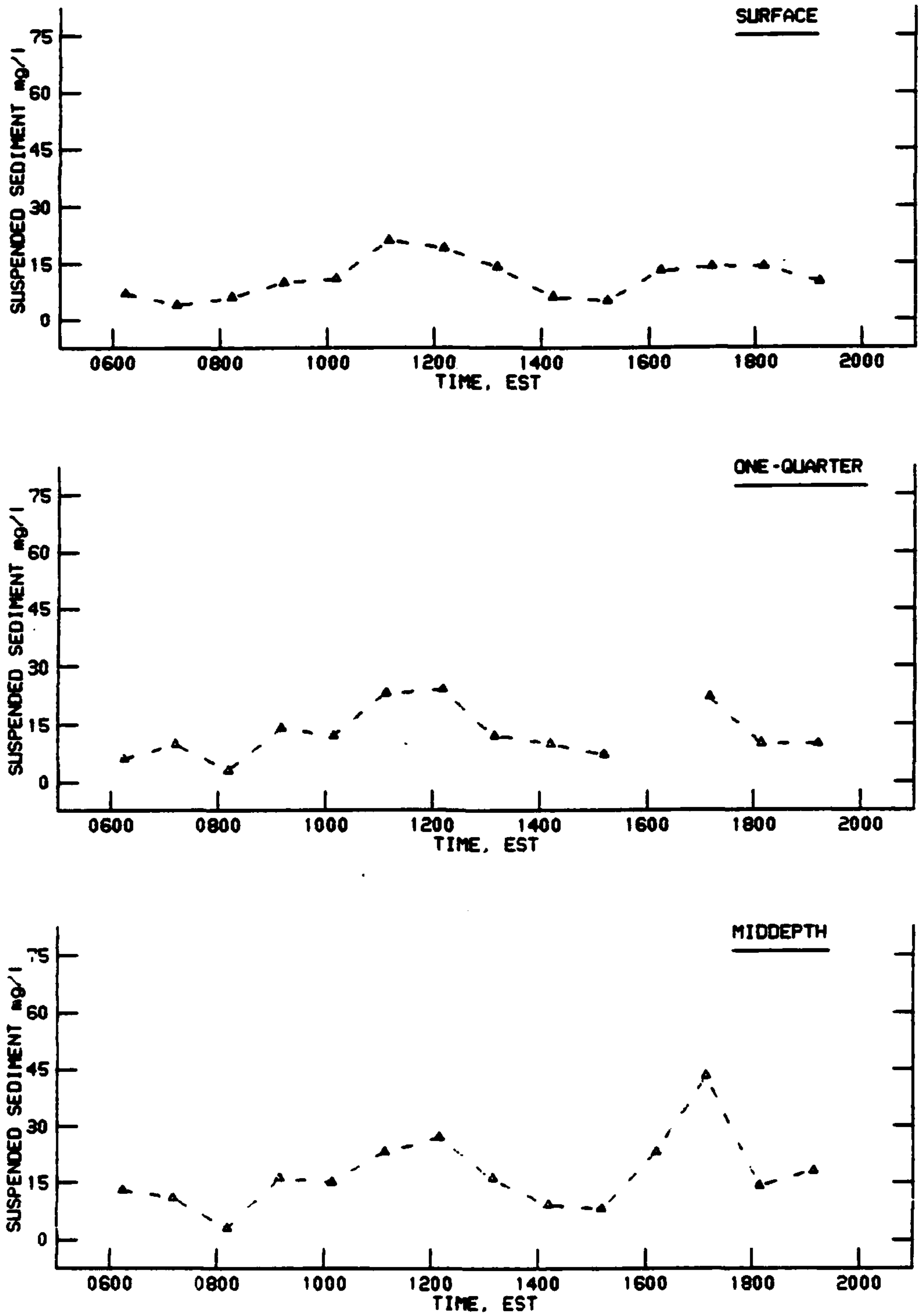




SUSPENDED SEDIMENT AT STATION 2A

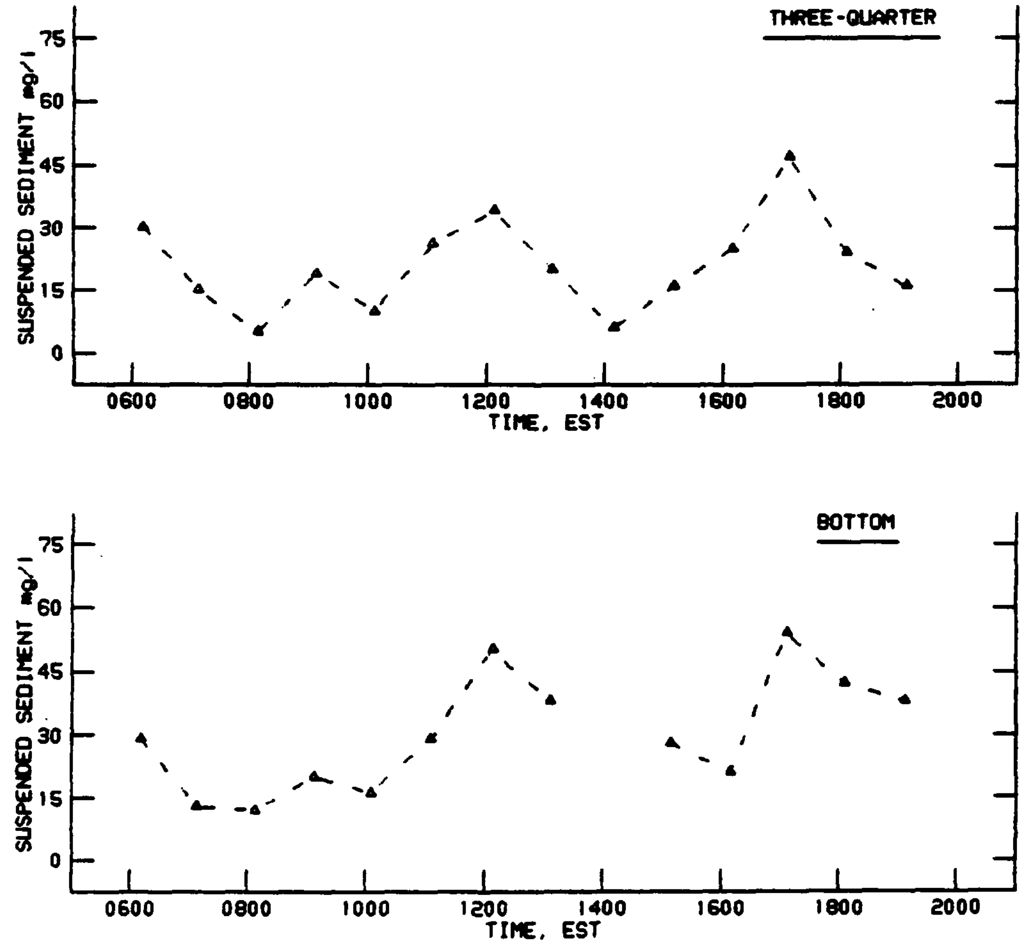
7 MAY 1990

PLATE 69
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 2B

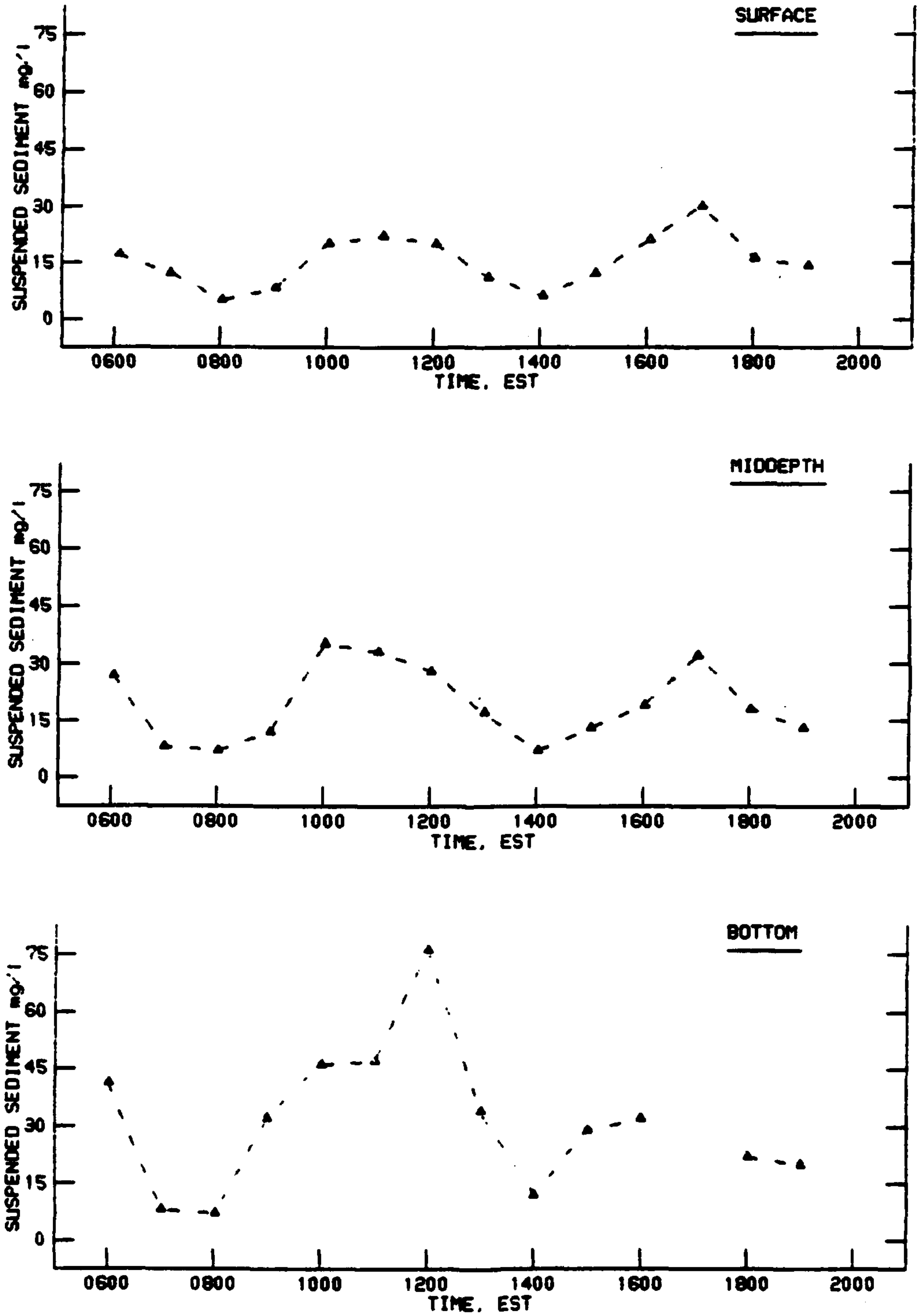
7 MAY 1990



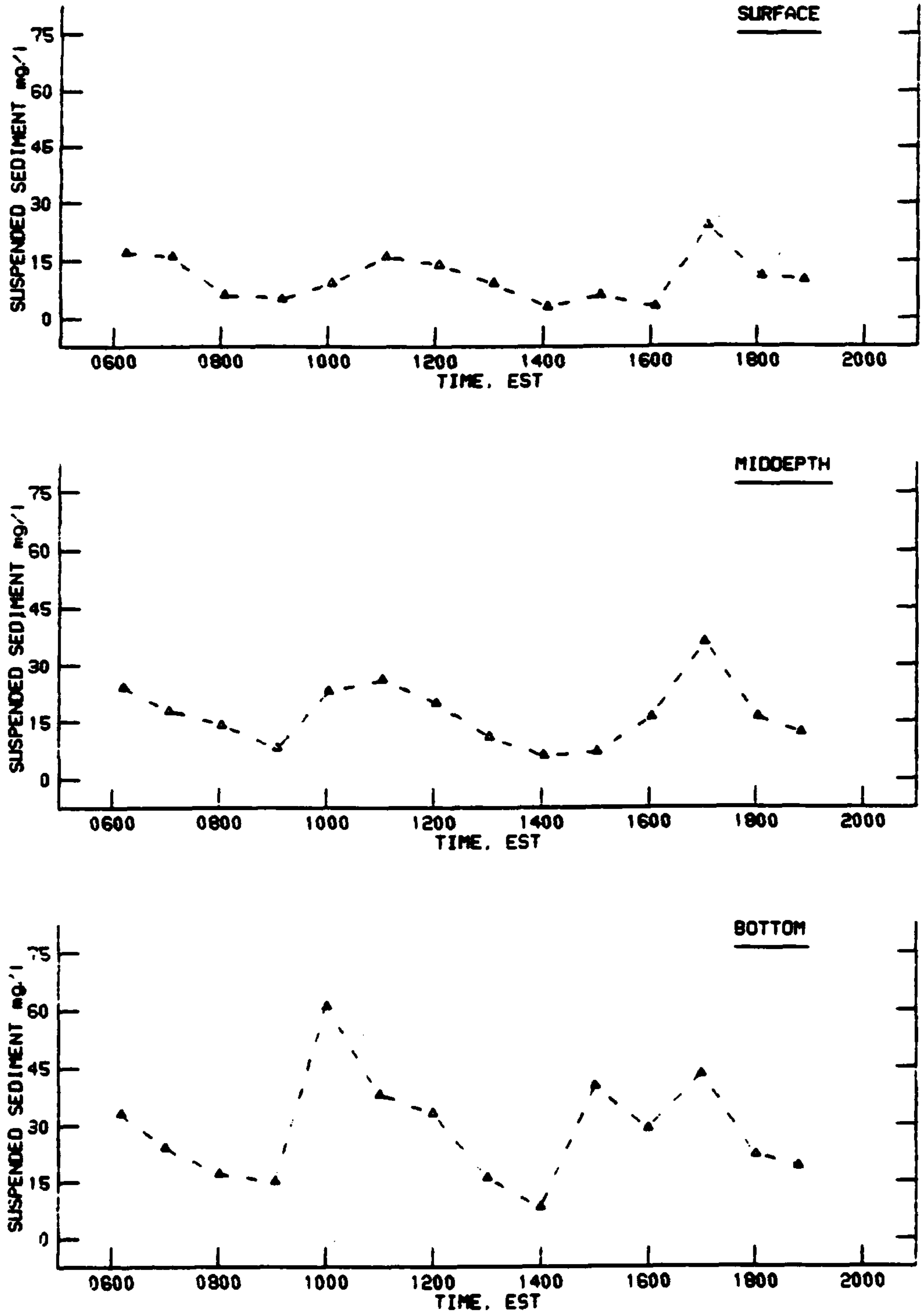
SUSPENDED SEDIMENT AT STATION 2B

7 MAY 1990

PLATE 70
(Sheet 2 of 2)

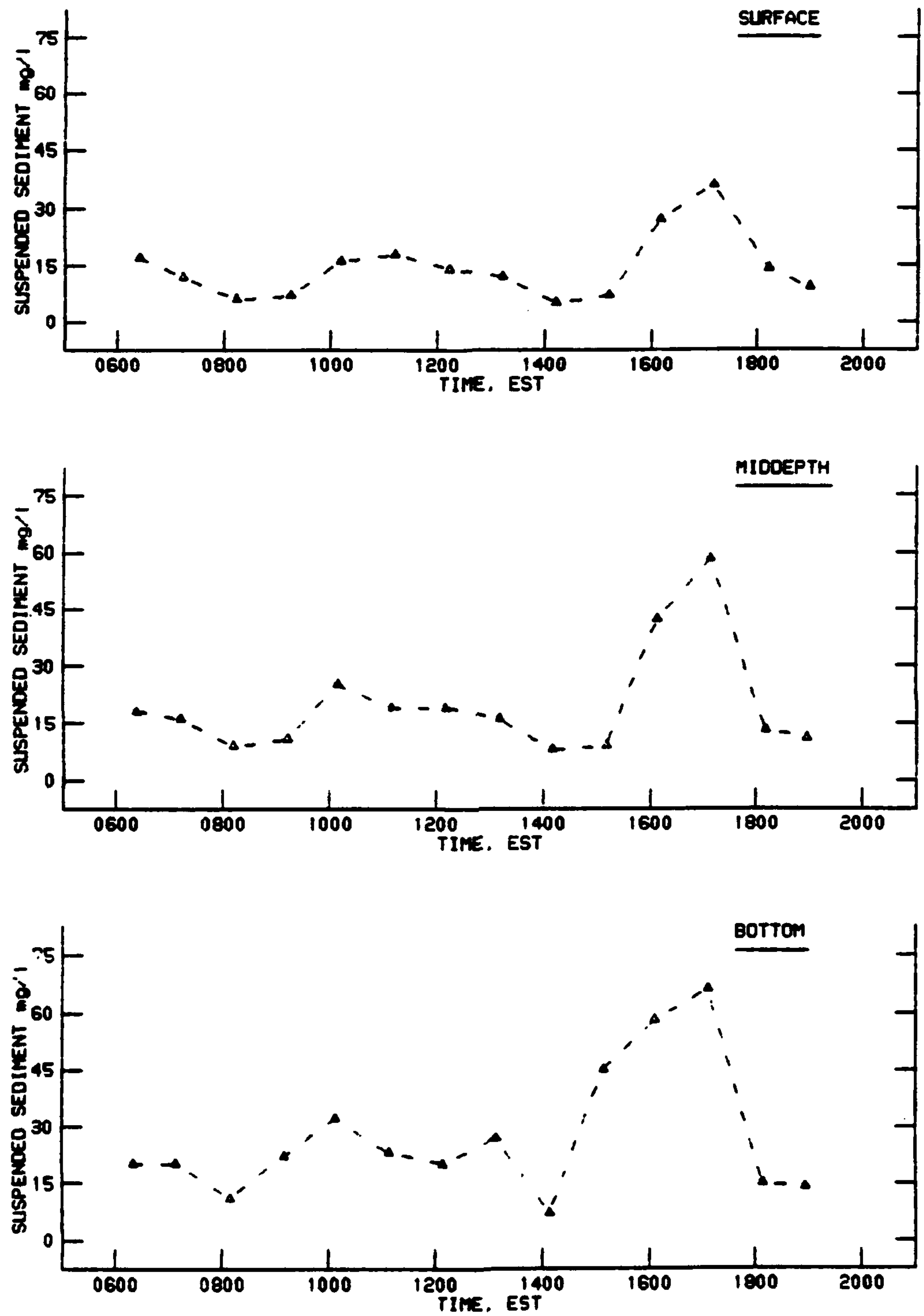


SUSPENDED SEDIMENT AT STATION 2C
7 MAY 1990



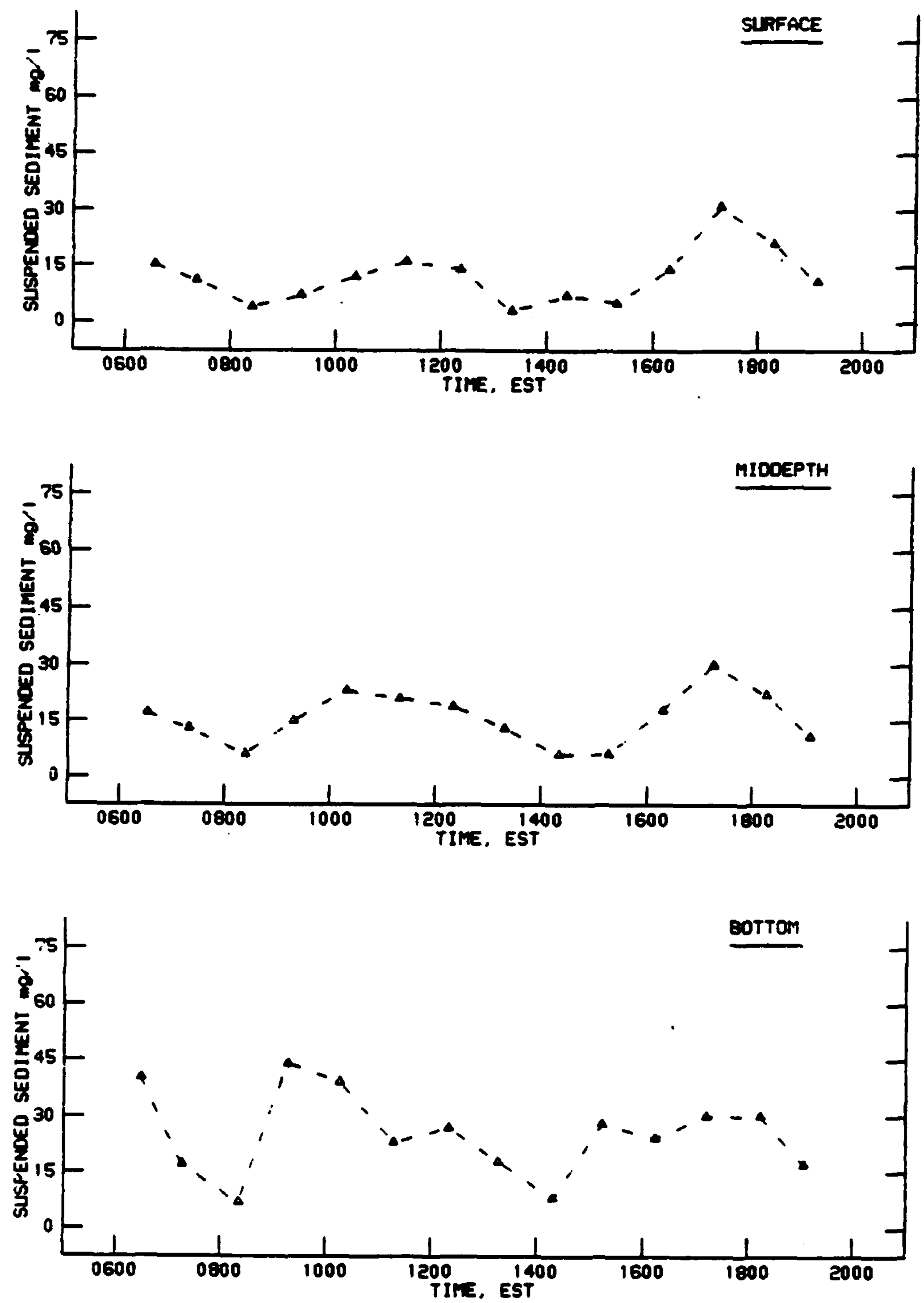
SUSPENDED SEDIMENT AT STATION 3A

7 MAY 1990

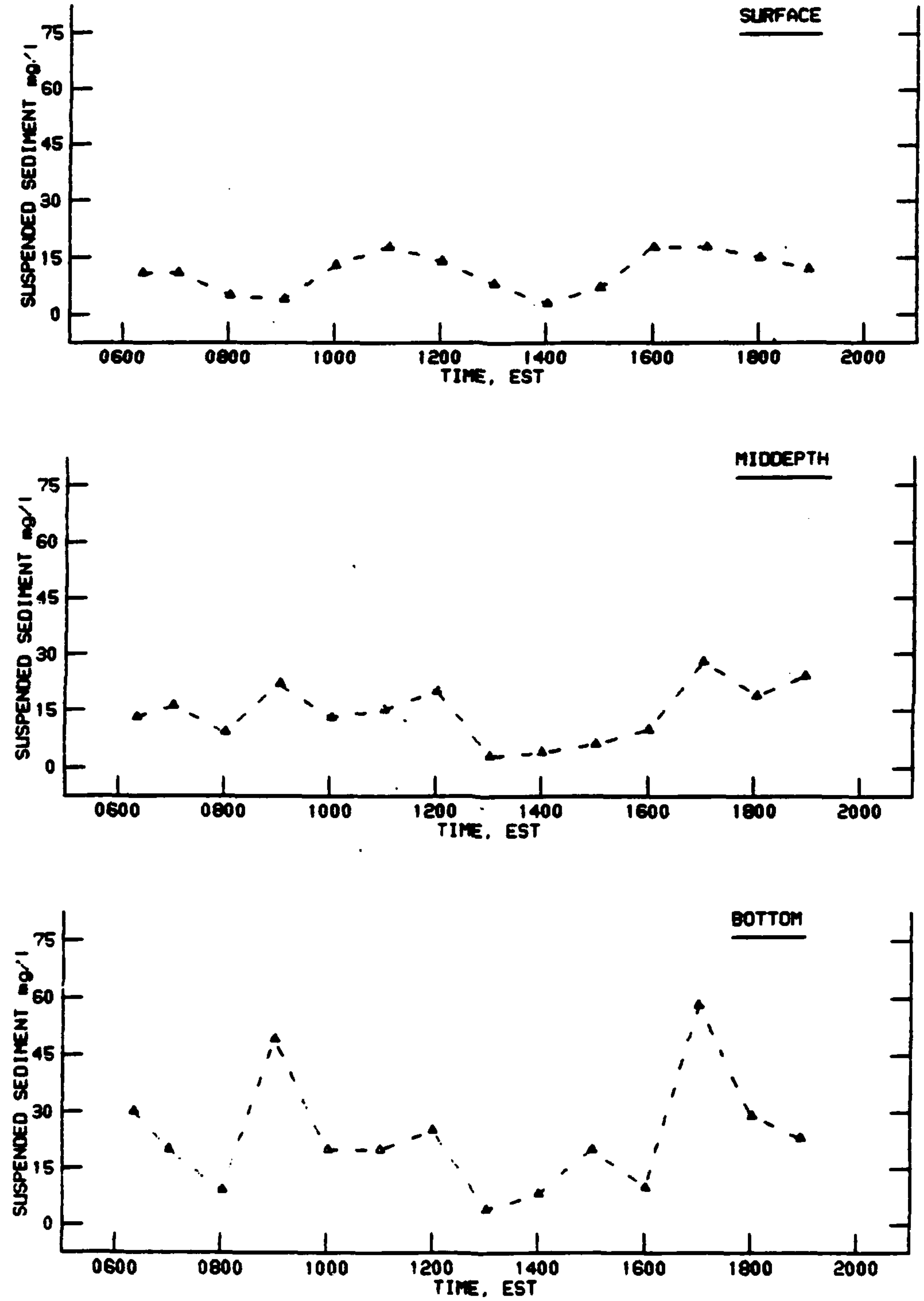


SUSPENDED SEDIMENT AT STATION 3B

7 MAY 1990

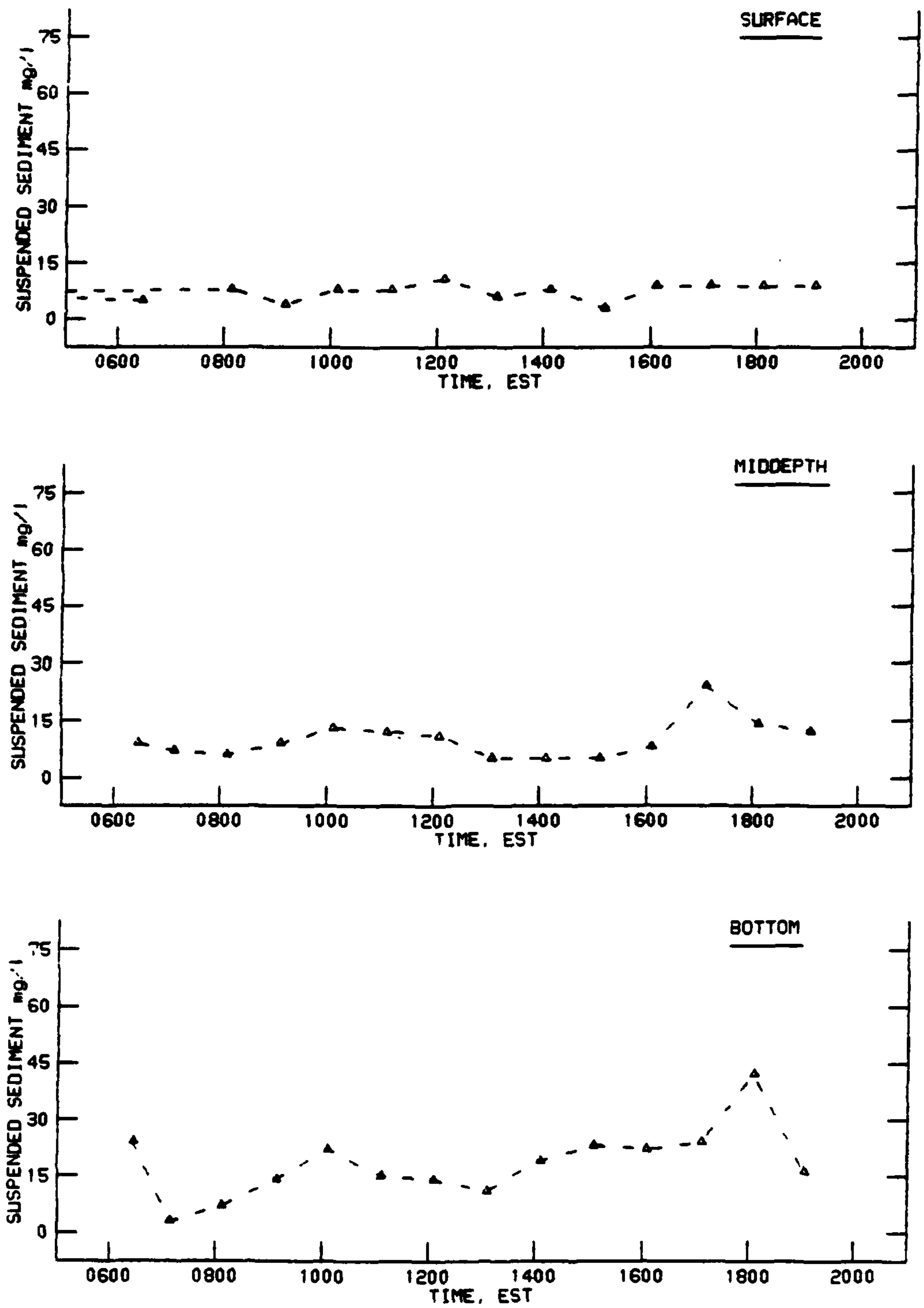


SUSPENDED SEDIMENT AT STATION 3C
7 MAY 1990

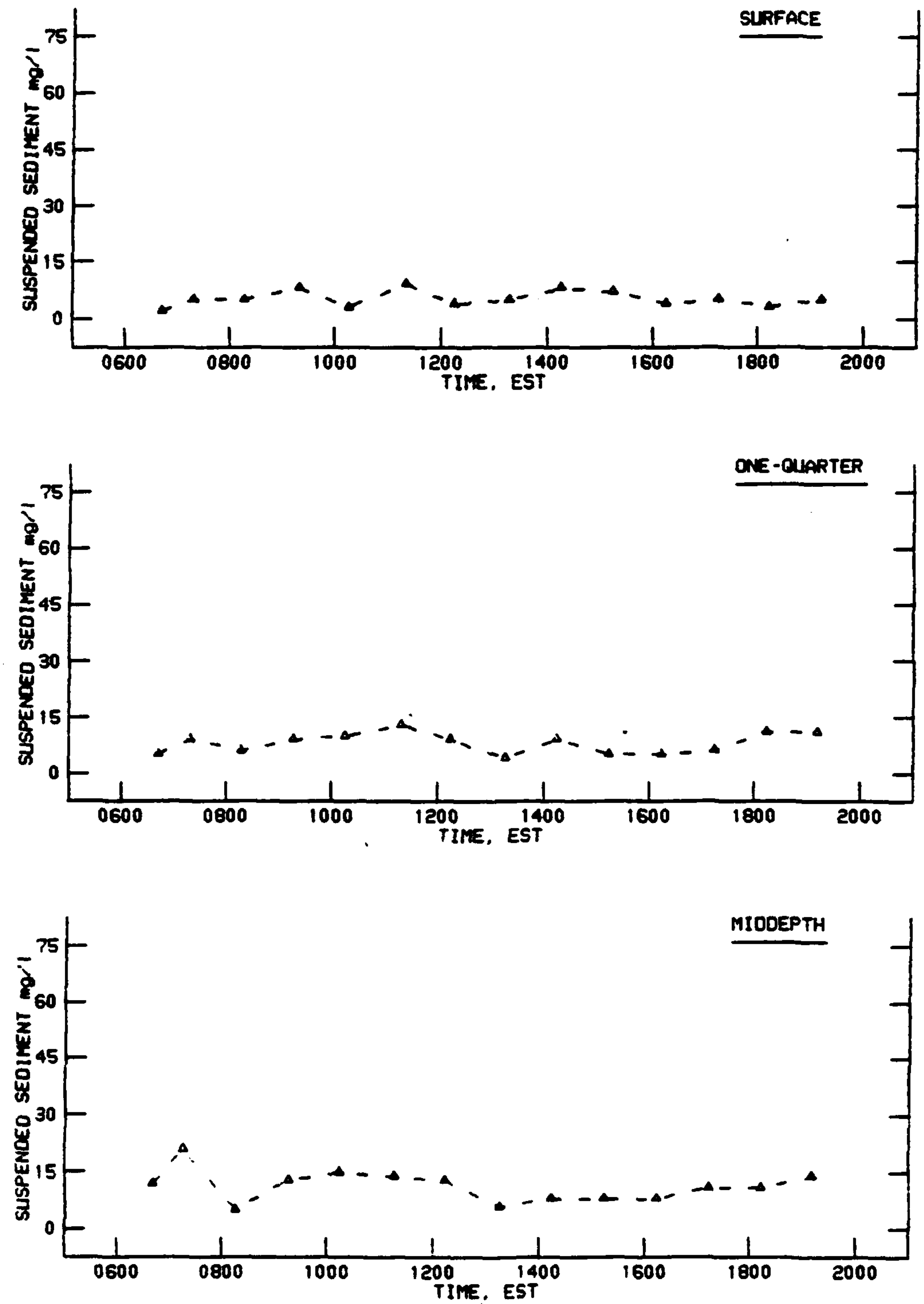


SUSPENDED SEDIMENT AT STATION 4A

7 MAY 1990

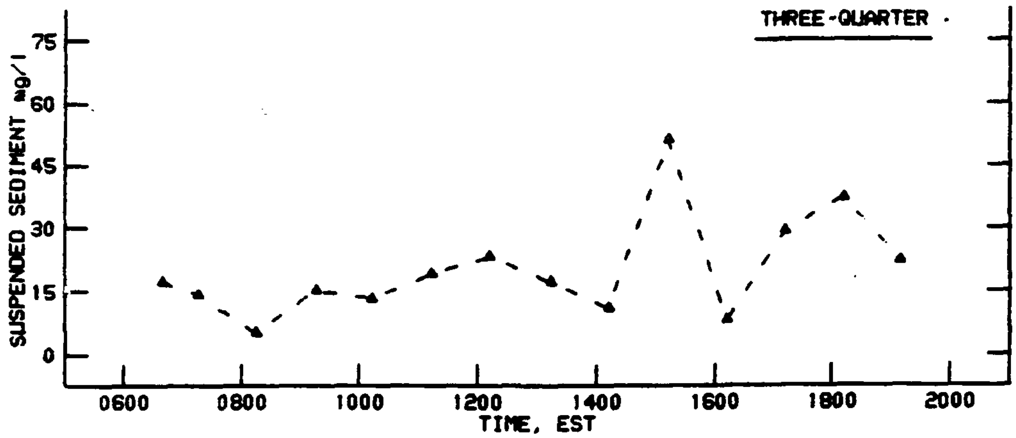


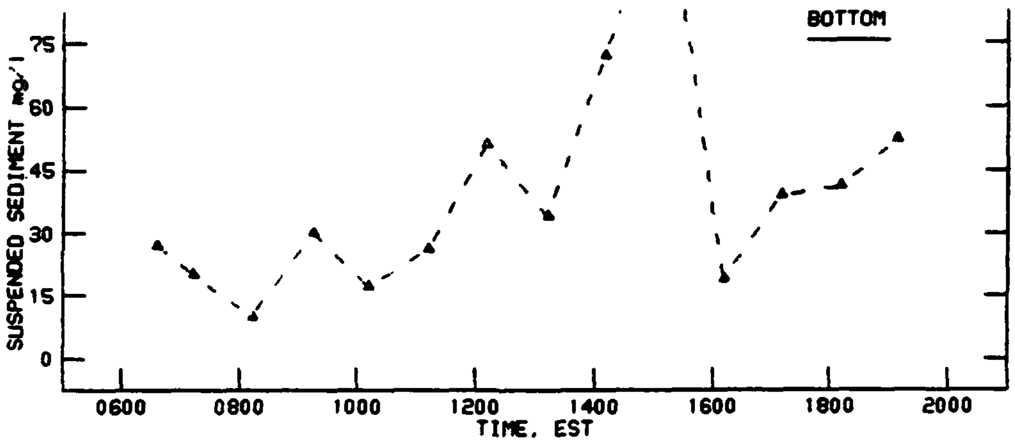
SUSPENDED SEDIMENT AT STATION 4B
7 MAY 1990



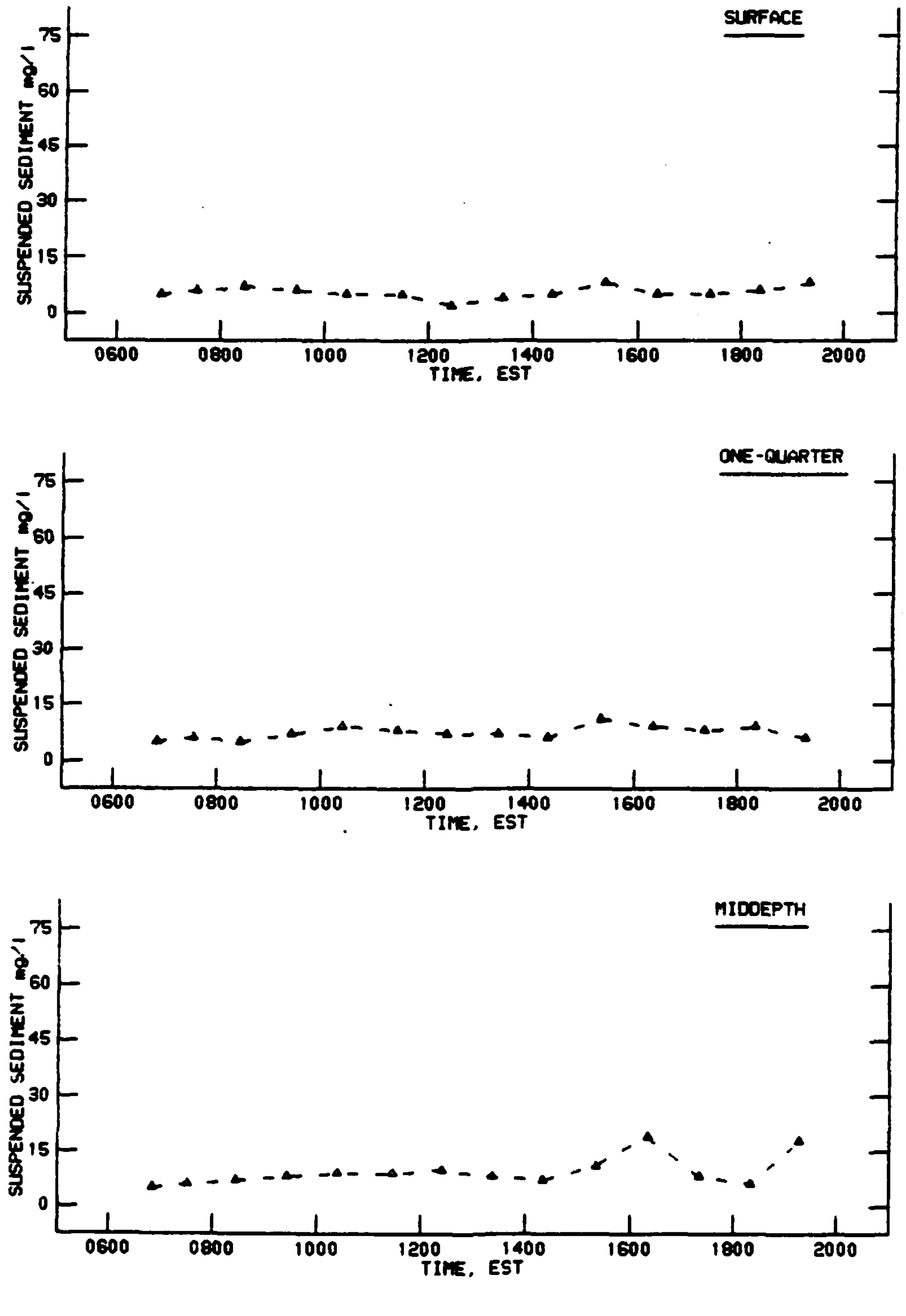
SUSPENDED SEDIMENT AT STATION 4C

7 MAY 1990

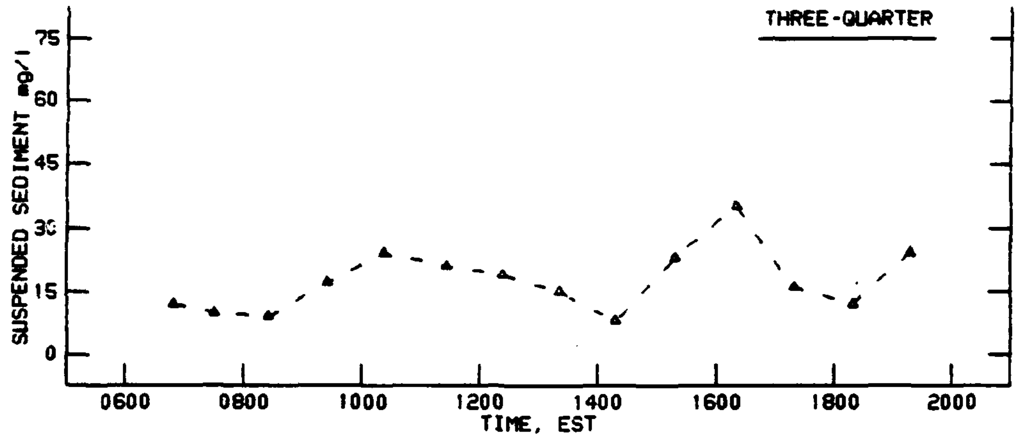


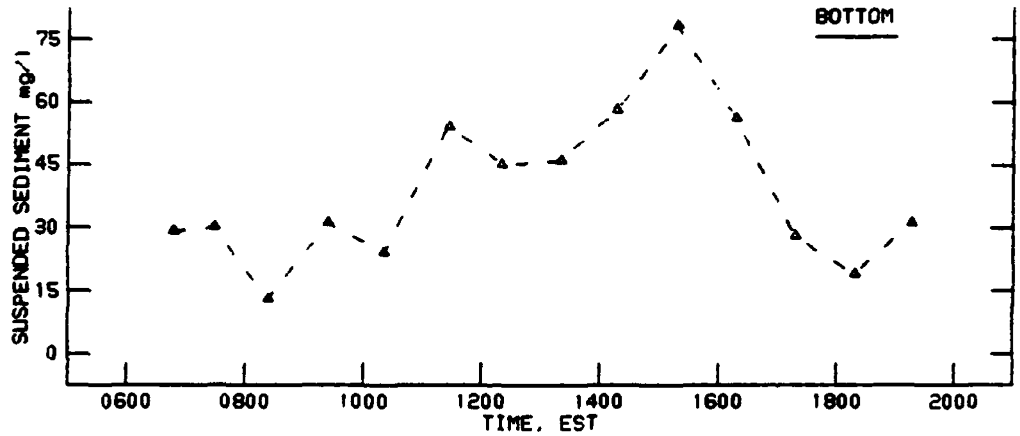


SUSPENDED SEDIMENT AT STATION 4C
7 MAY 1990



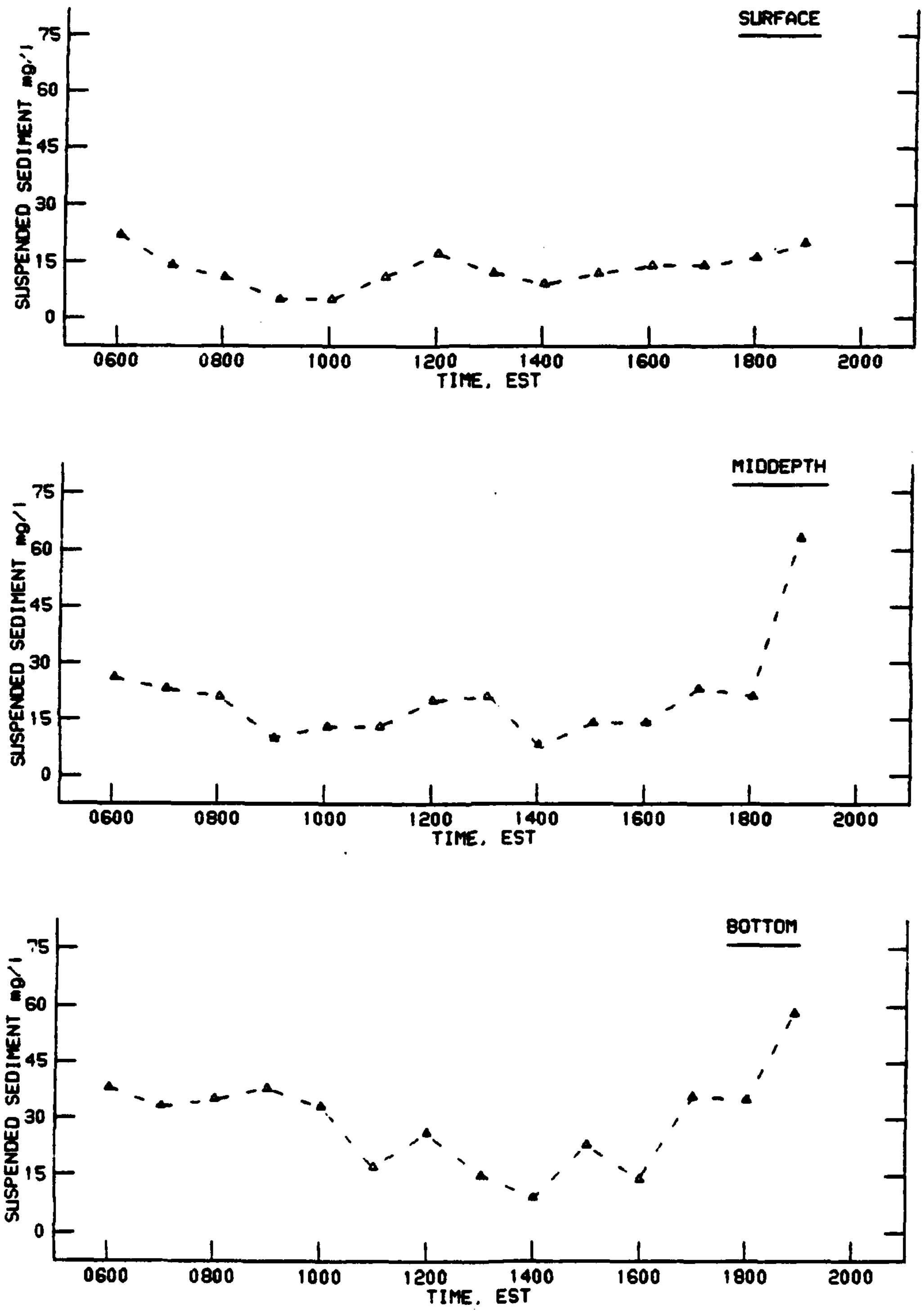
SUSPENDED SEDIMENT AT STATION 4D
7 MAY 1990





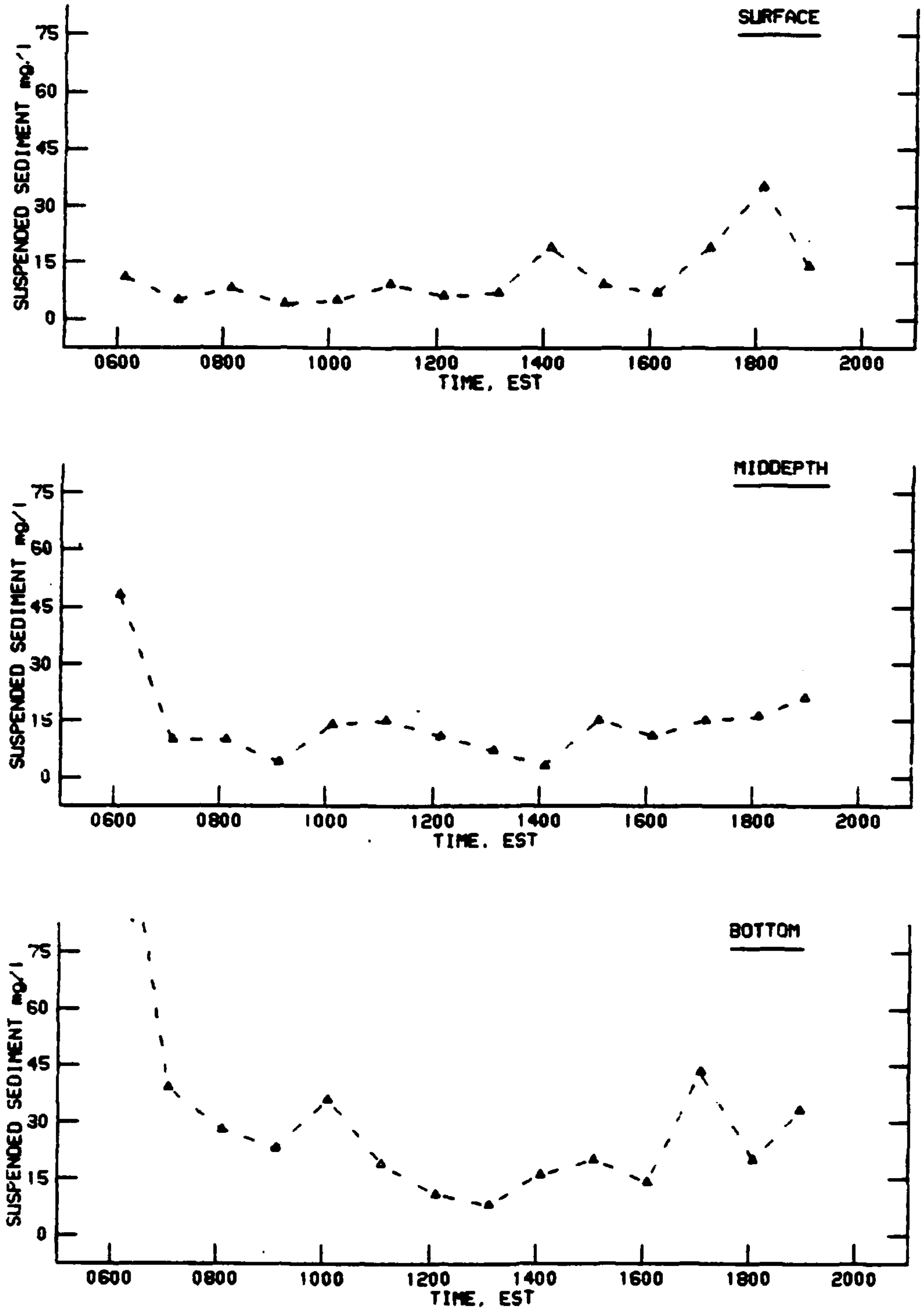
SUSPENDED SEDIMENT AT STATION 4D

7 MAY 1990



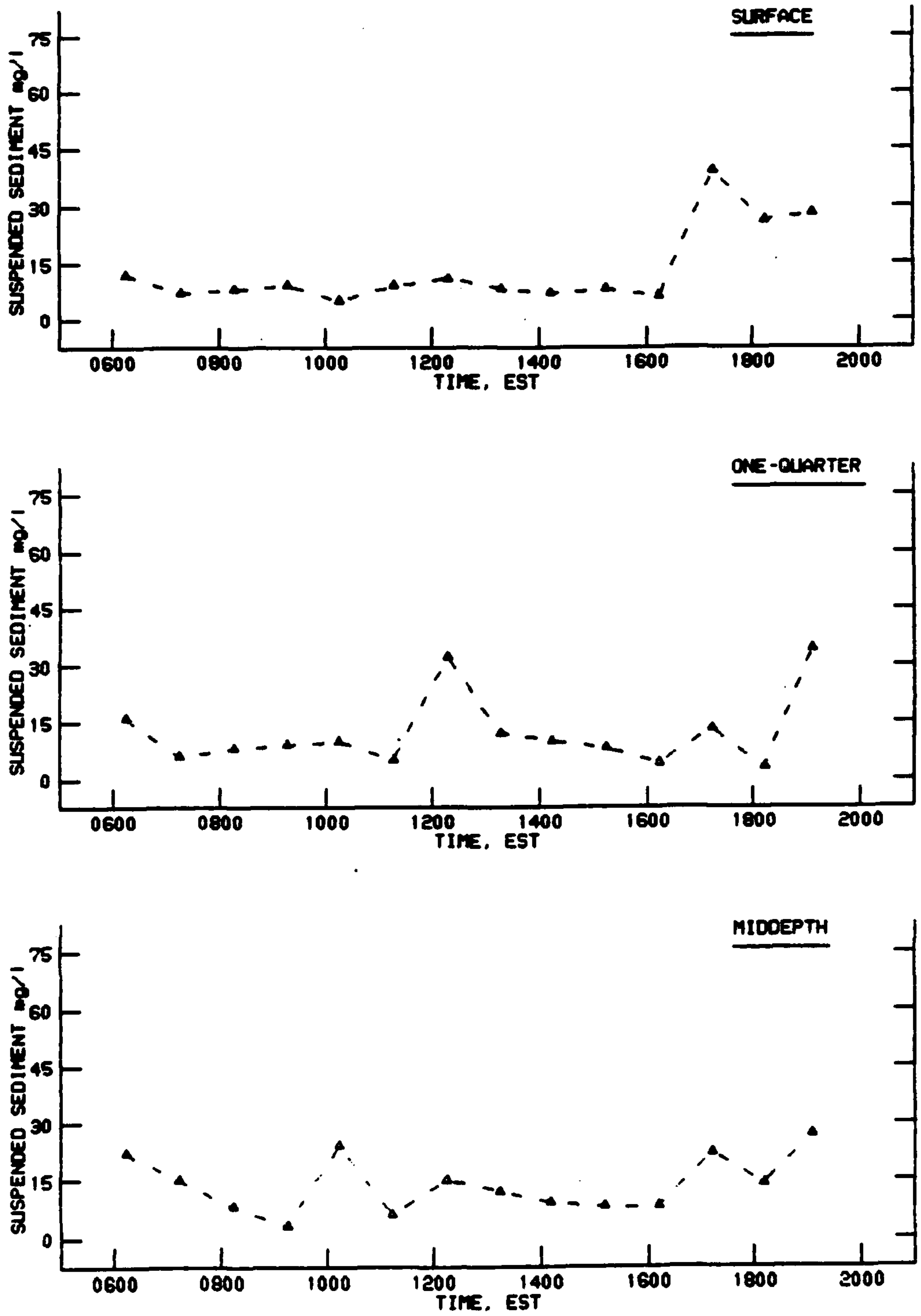
SUSPENDED SEDIMENT AT STATION 4A

8 MAY 1990



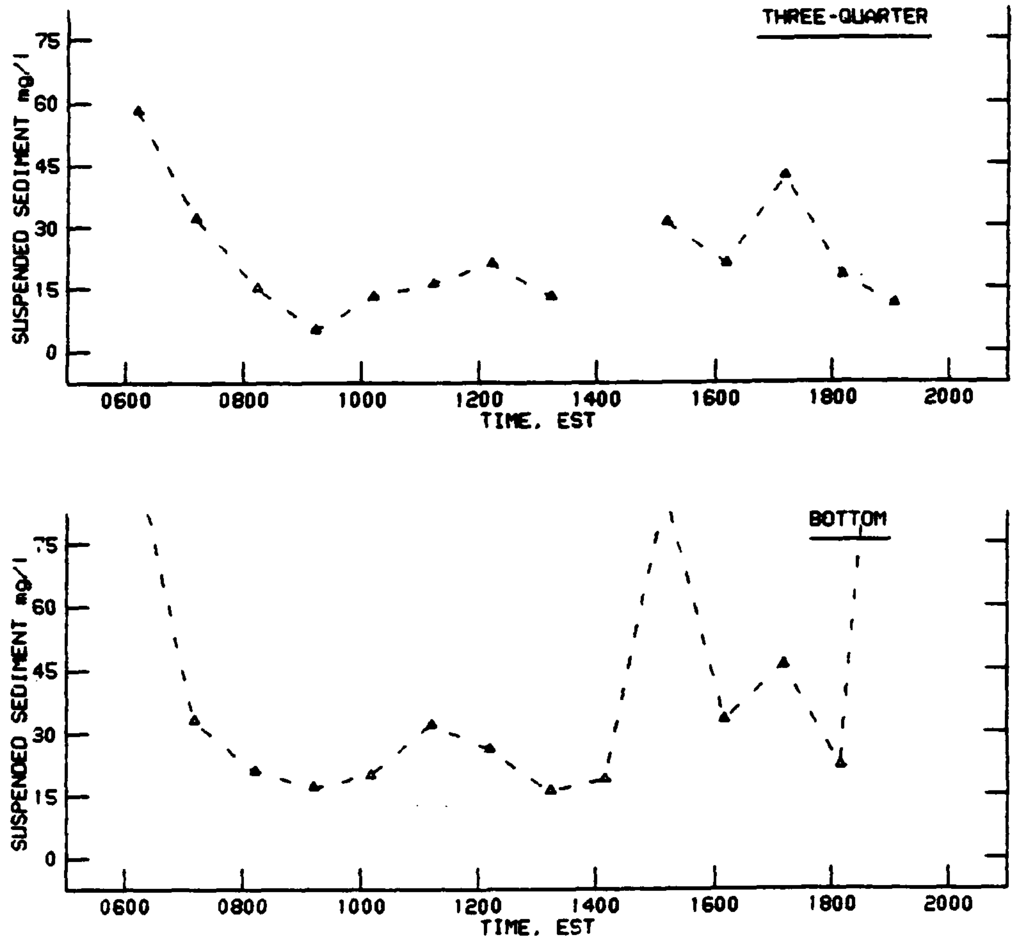
SUSPENDED SEDIMENT AT STATION 4B

8 MAY 1990

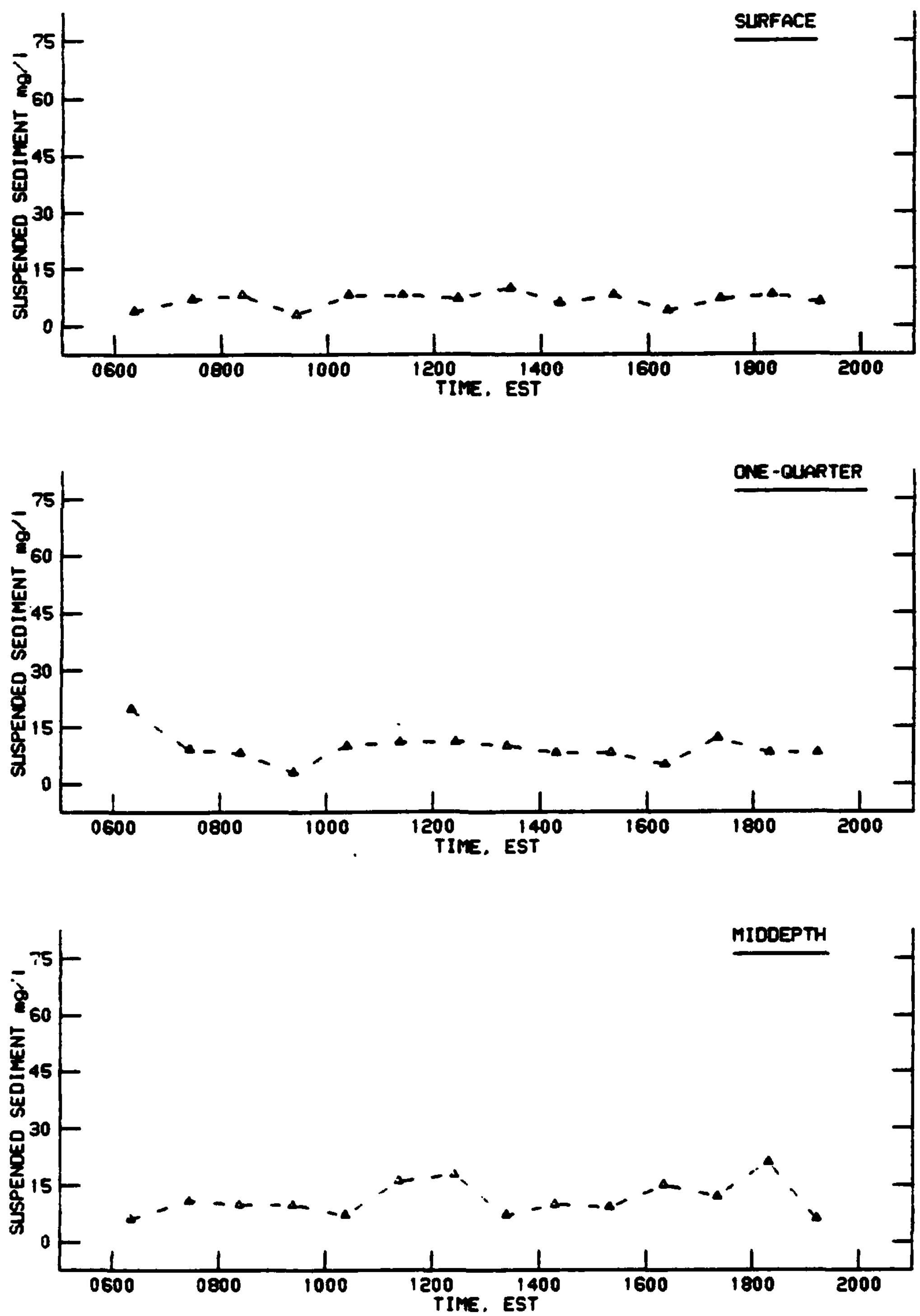


SUSPENDED SEDIMENT AT STATION 4C

8 MAY 1990

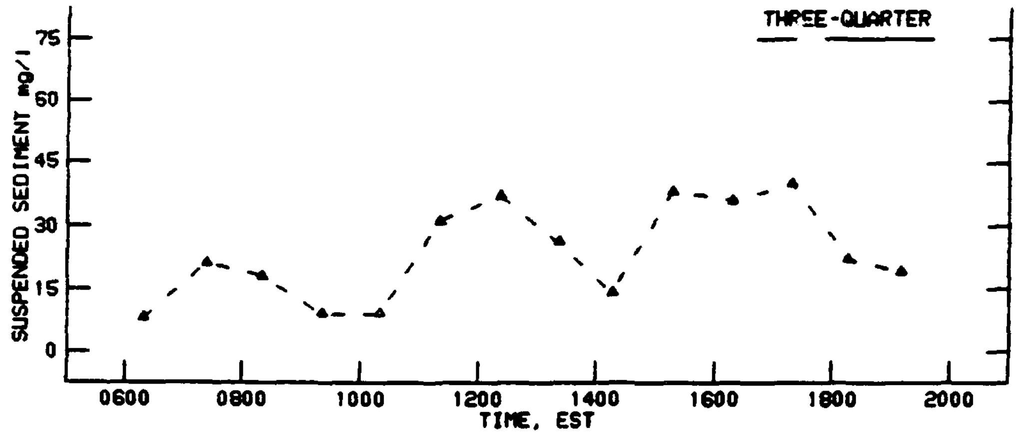


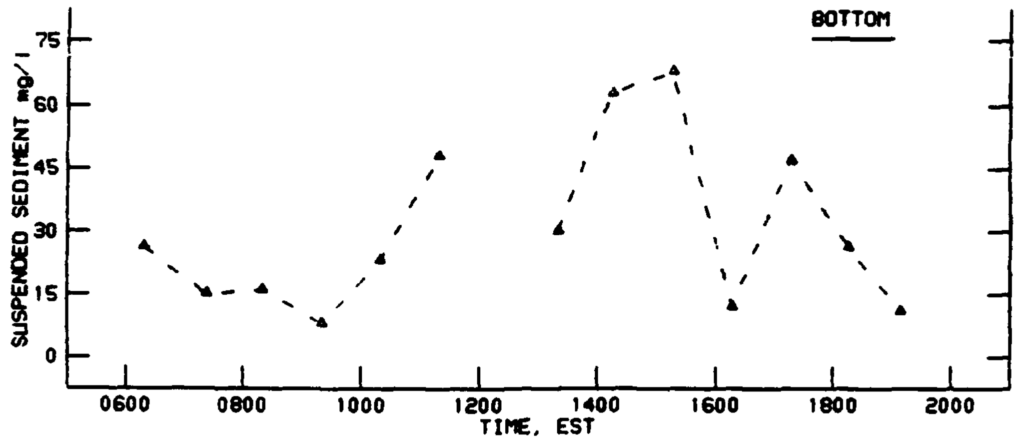
SUSPENDED SEDIMENT AT STATION 4C
8 MAY 1990



SUSPENDED SEDIMENT AT STATION 4D

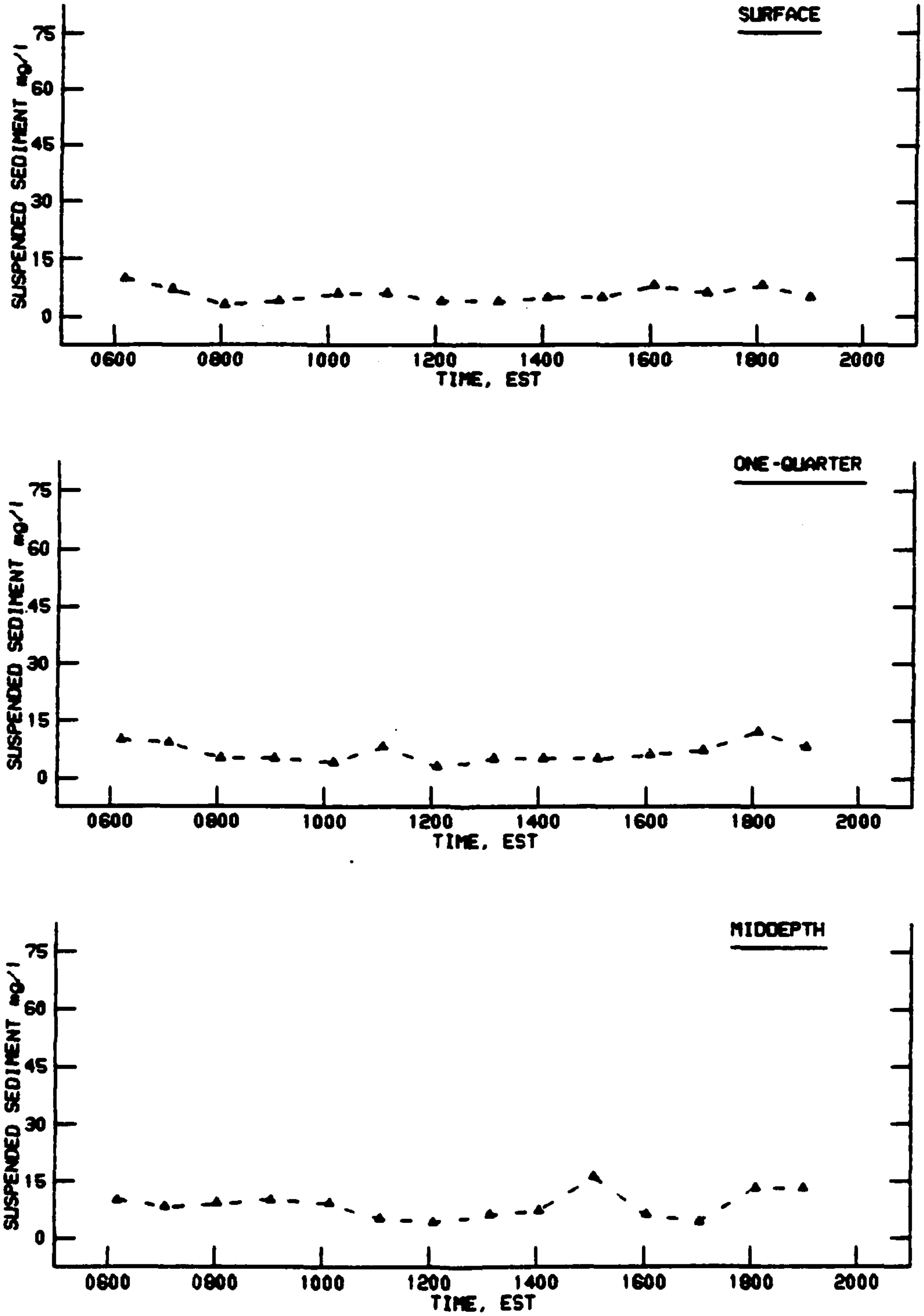
8 MAY 1990





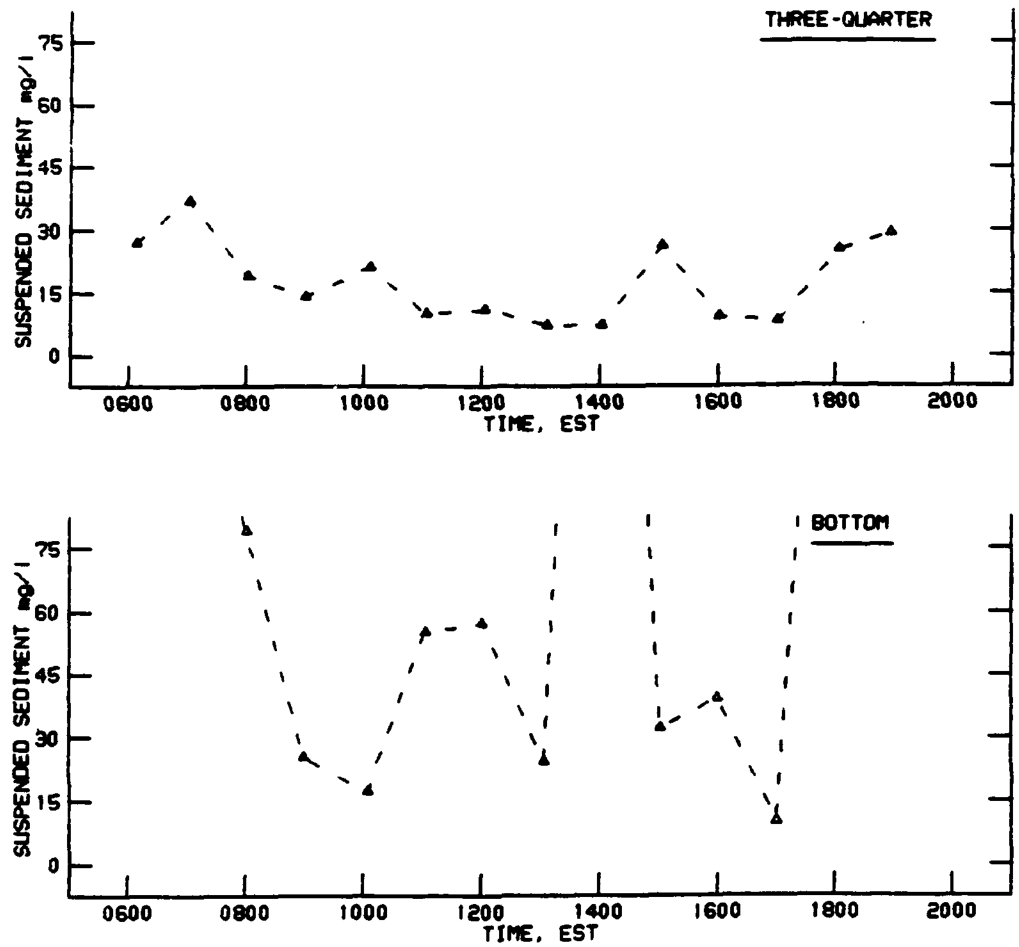
SUSPENDED SEDIMENT AT STATION 4D

8 MAY 1990



SUSPENDED SEDIMENT AT STATION 5A
8 MAY 1990

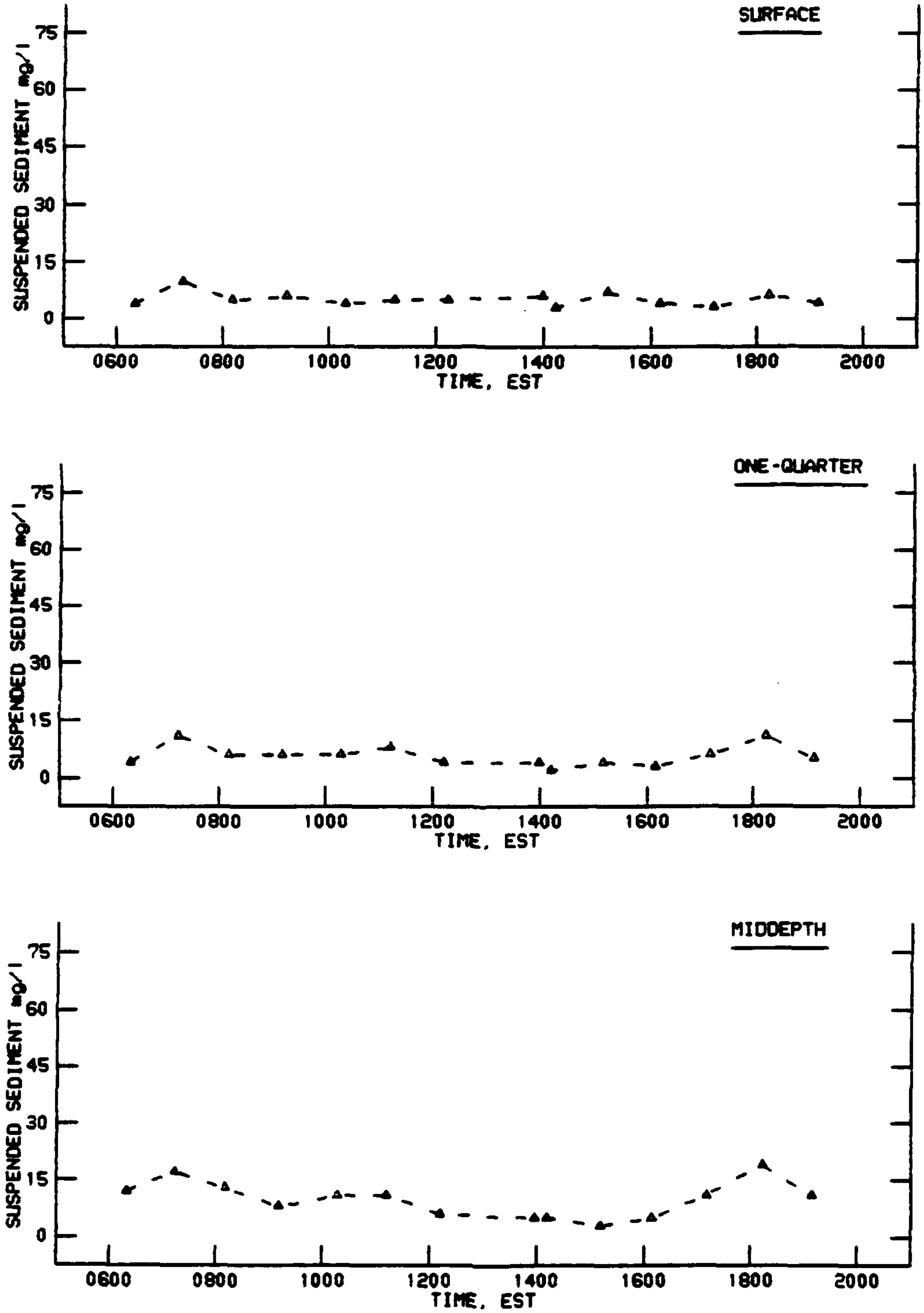
PLATE 83
(Sheet 1 of 2)



SUSPENDED SEDIMENT AT STATION 5A

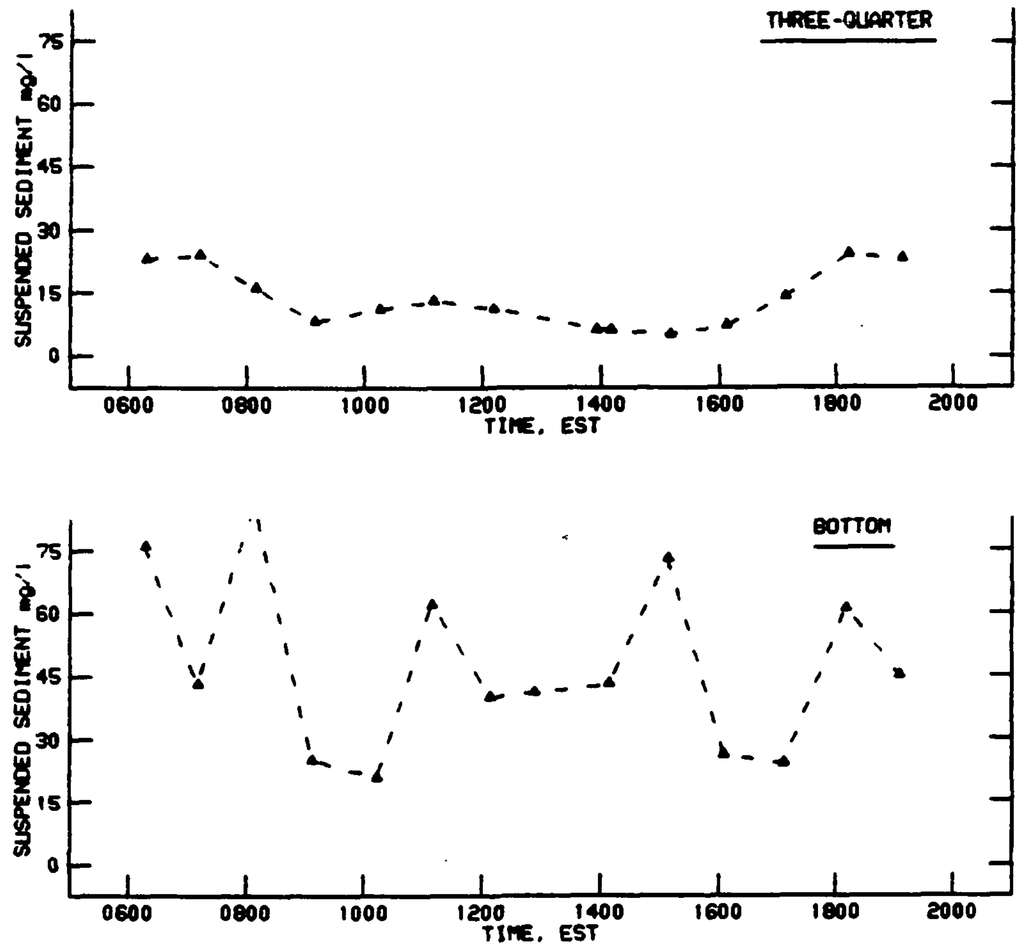
8 MAY 1990

PLATE 83
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 5B

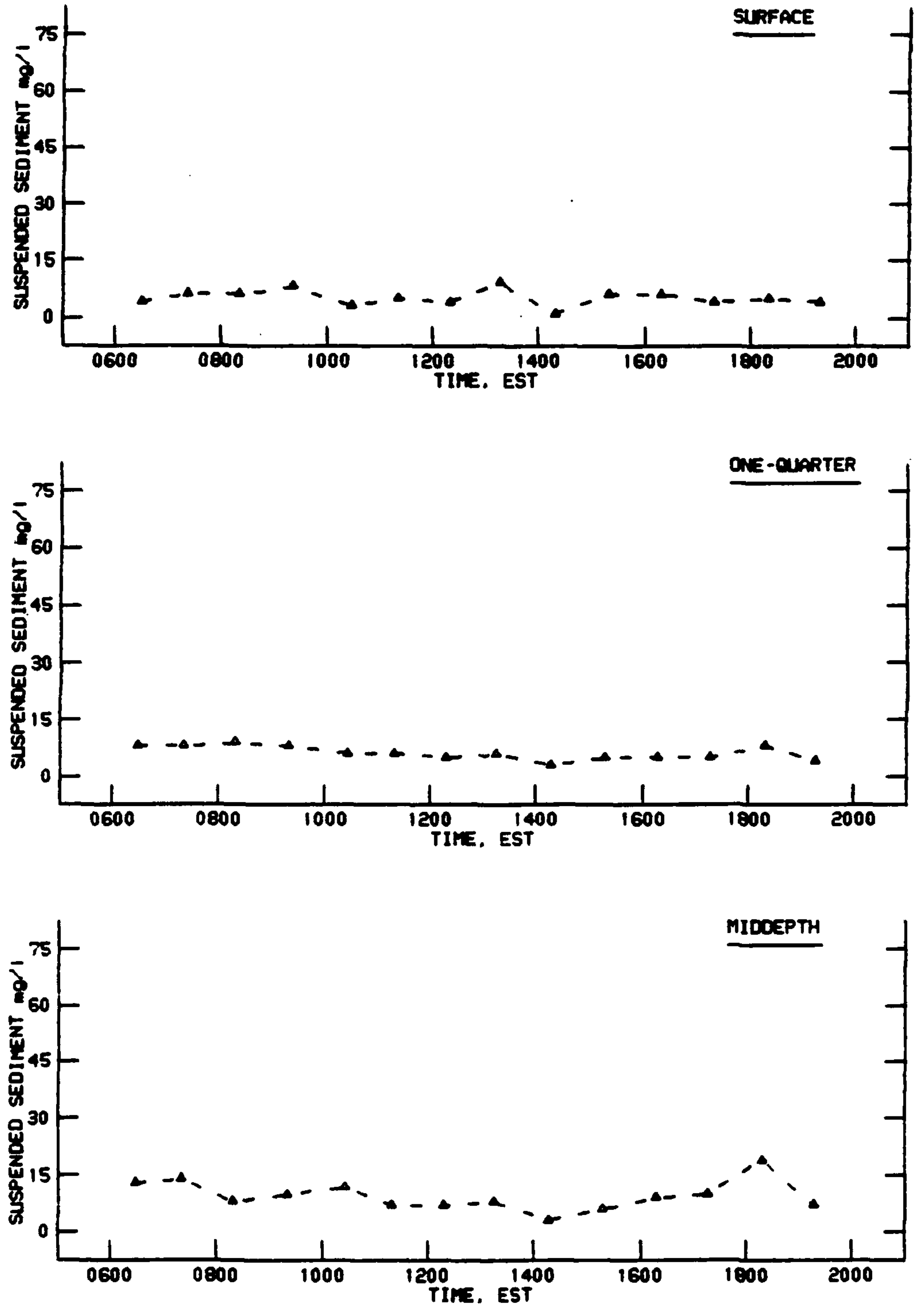
8 MAY 1990



SUSPENDED SEDIMENT AT STATION 5B

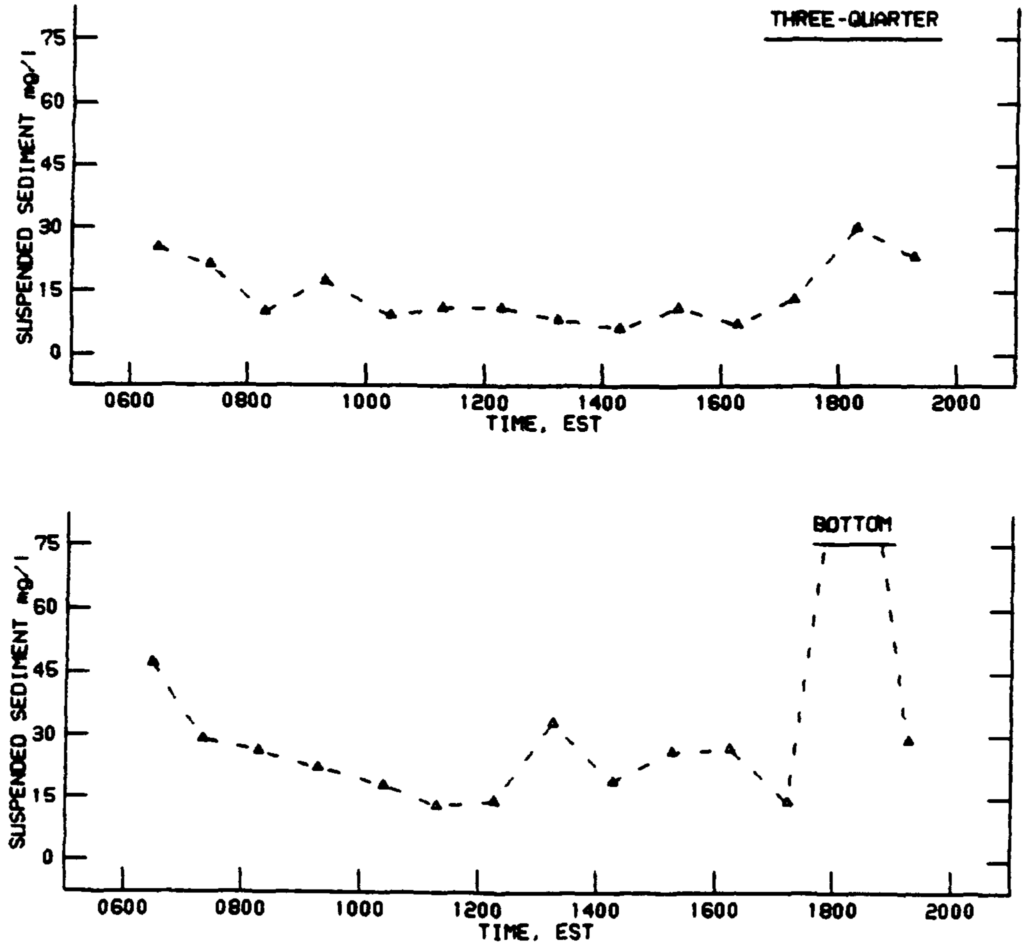
8 MAY 1990

PLATE 84
(Sheet 2 of 2)



SUSPENDED SEDIMENT AT STATION 5C

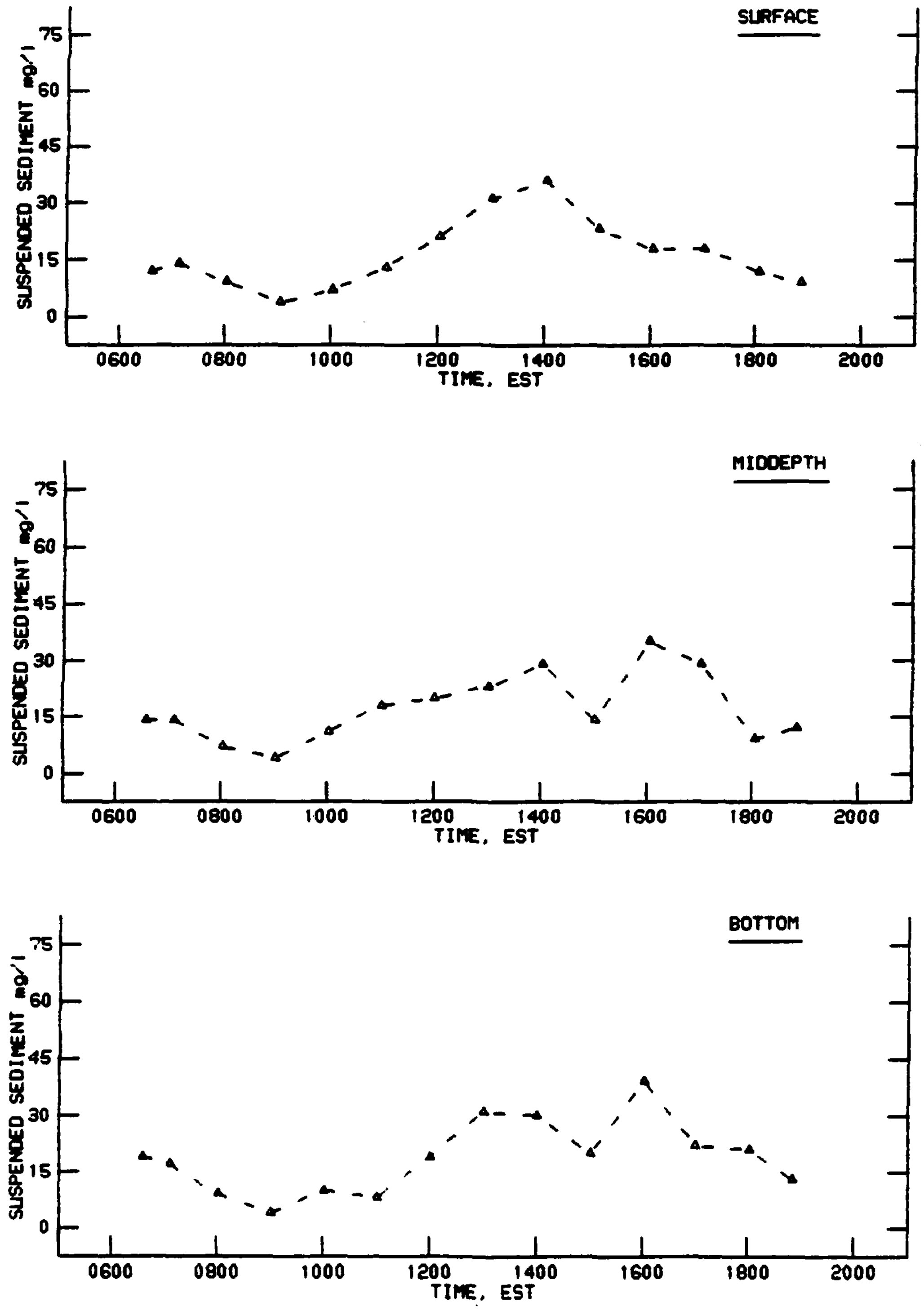
8 MAY 1990



SUSPENDED SEDIMENT AT STATION 5C

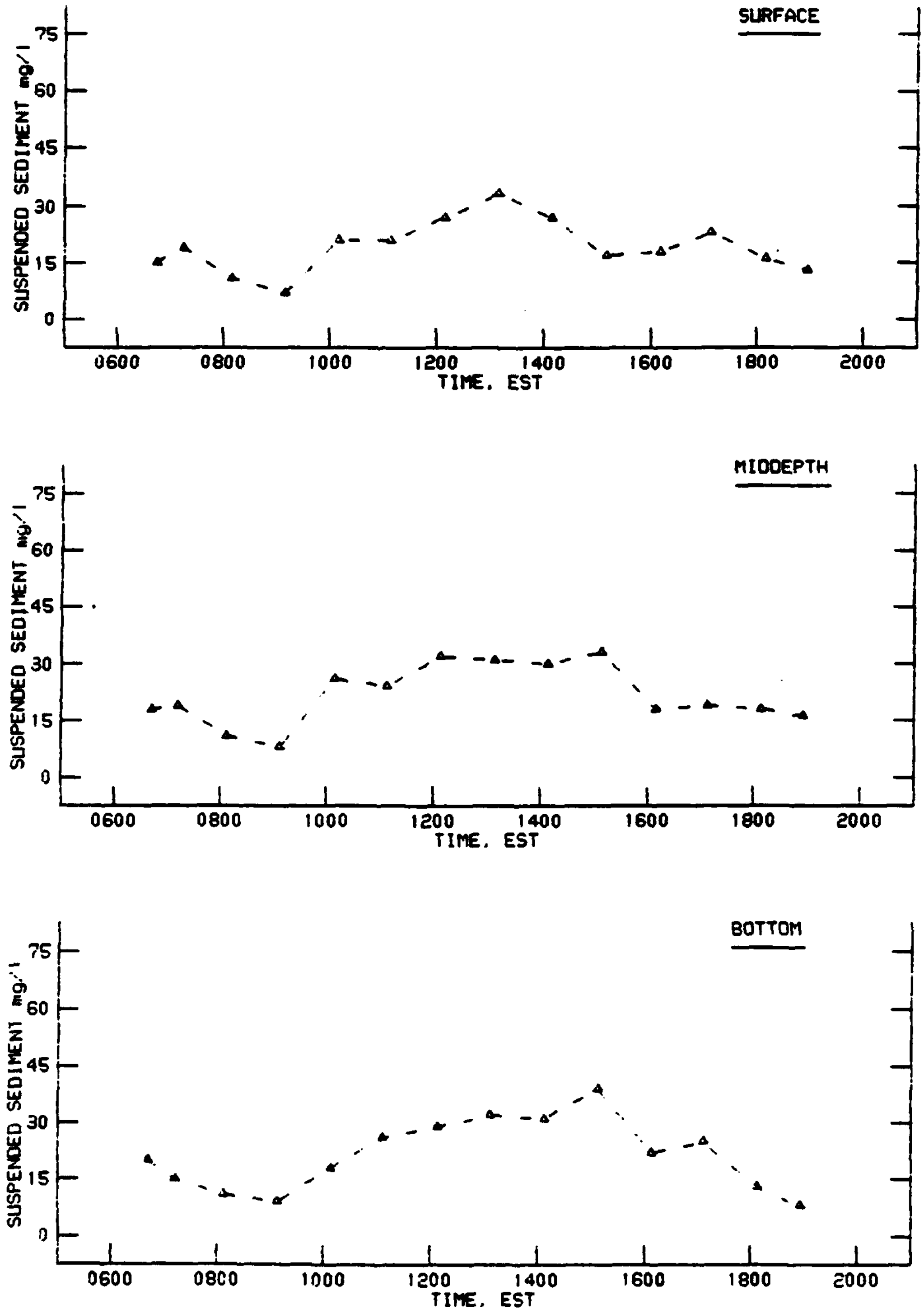
8 MAY 1990

PLATE 85
(Sheet 2 of 2)



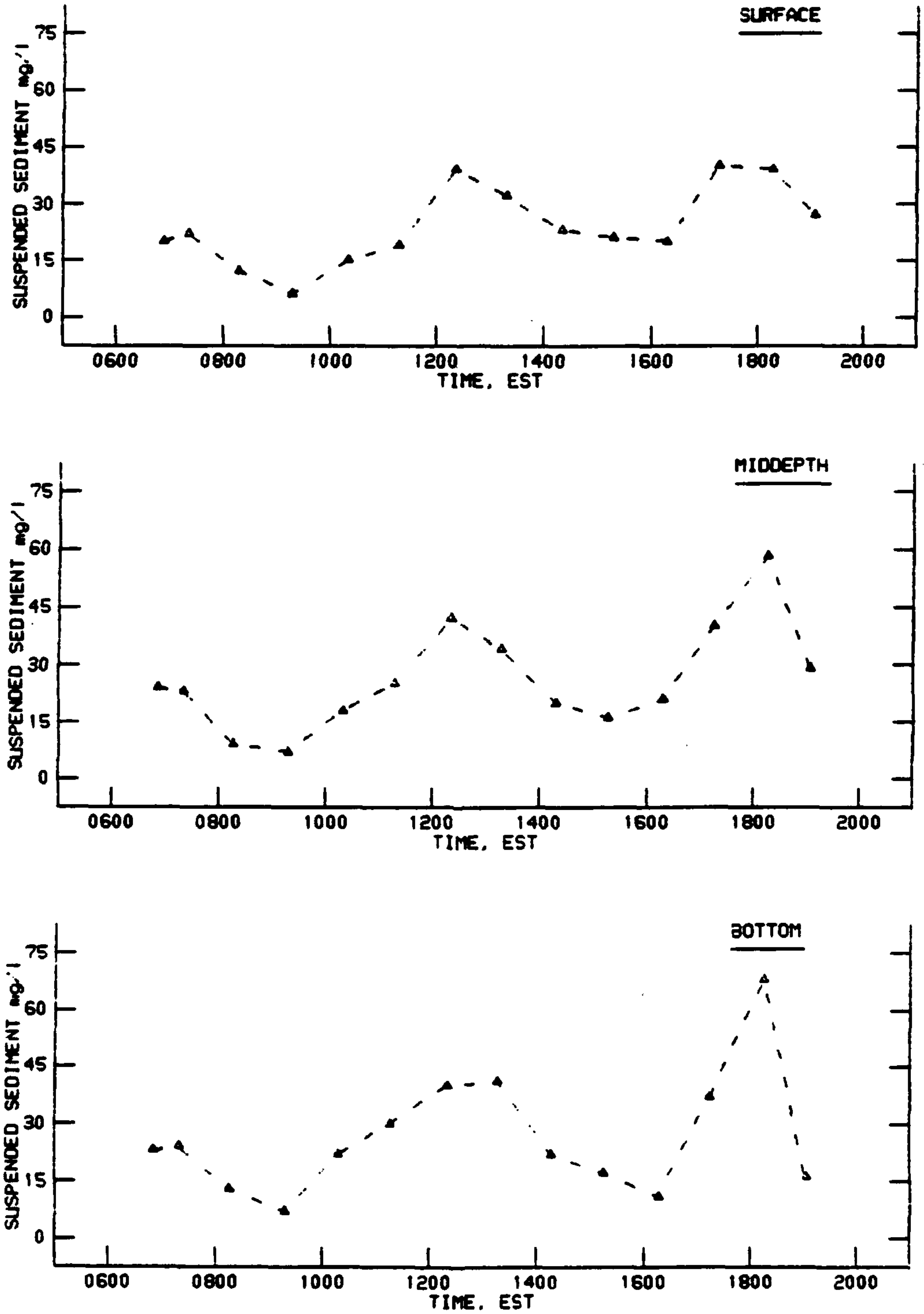
SUSPENDED SEDIMENT AT STATION 7A

8 MAY 1990



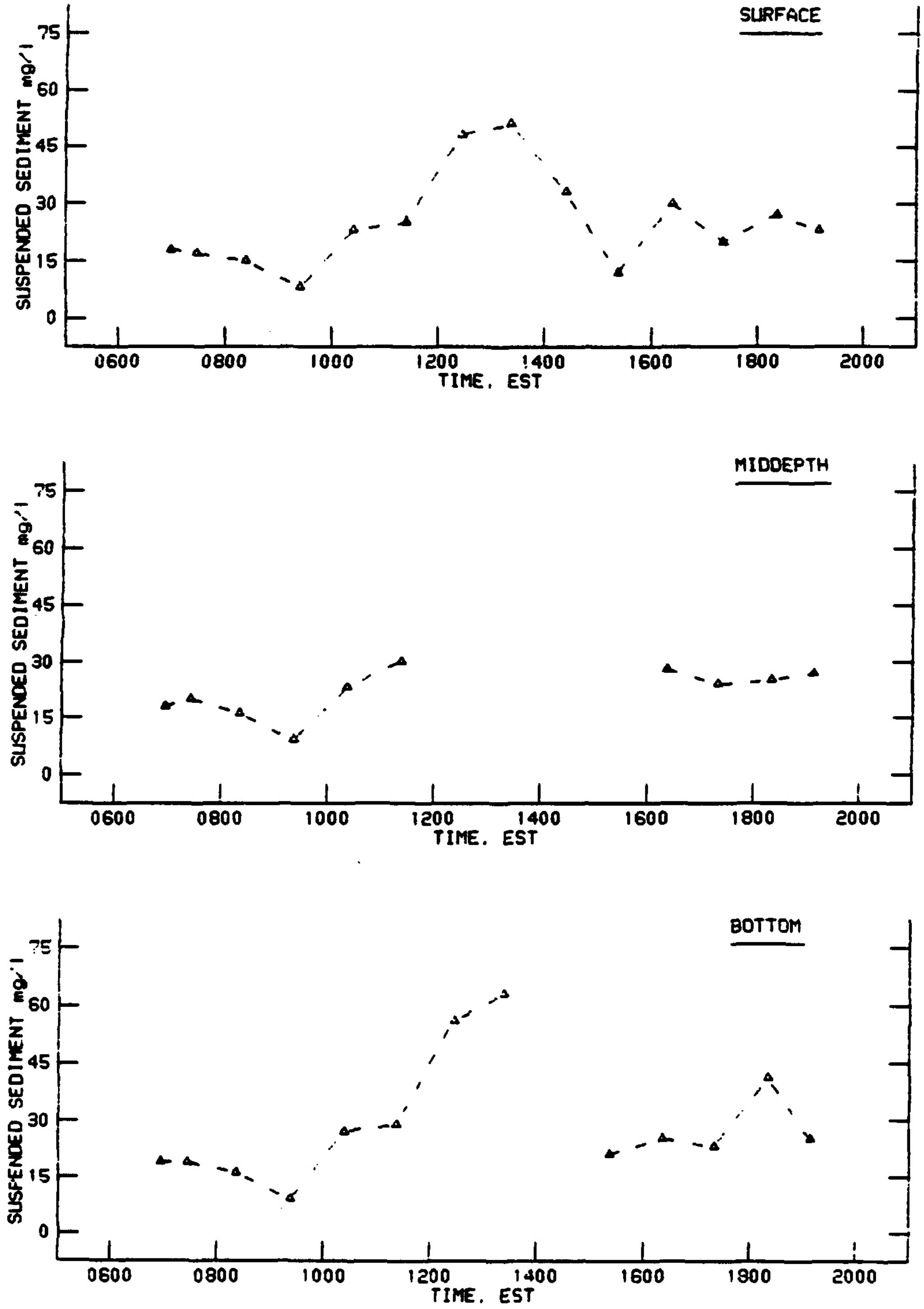
SUSPENDED SEDIMENT AT STATION 7B

8 MAY 1990



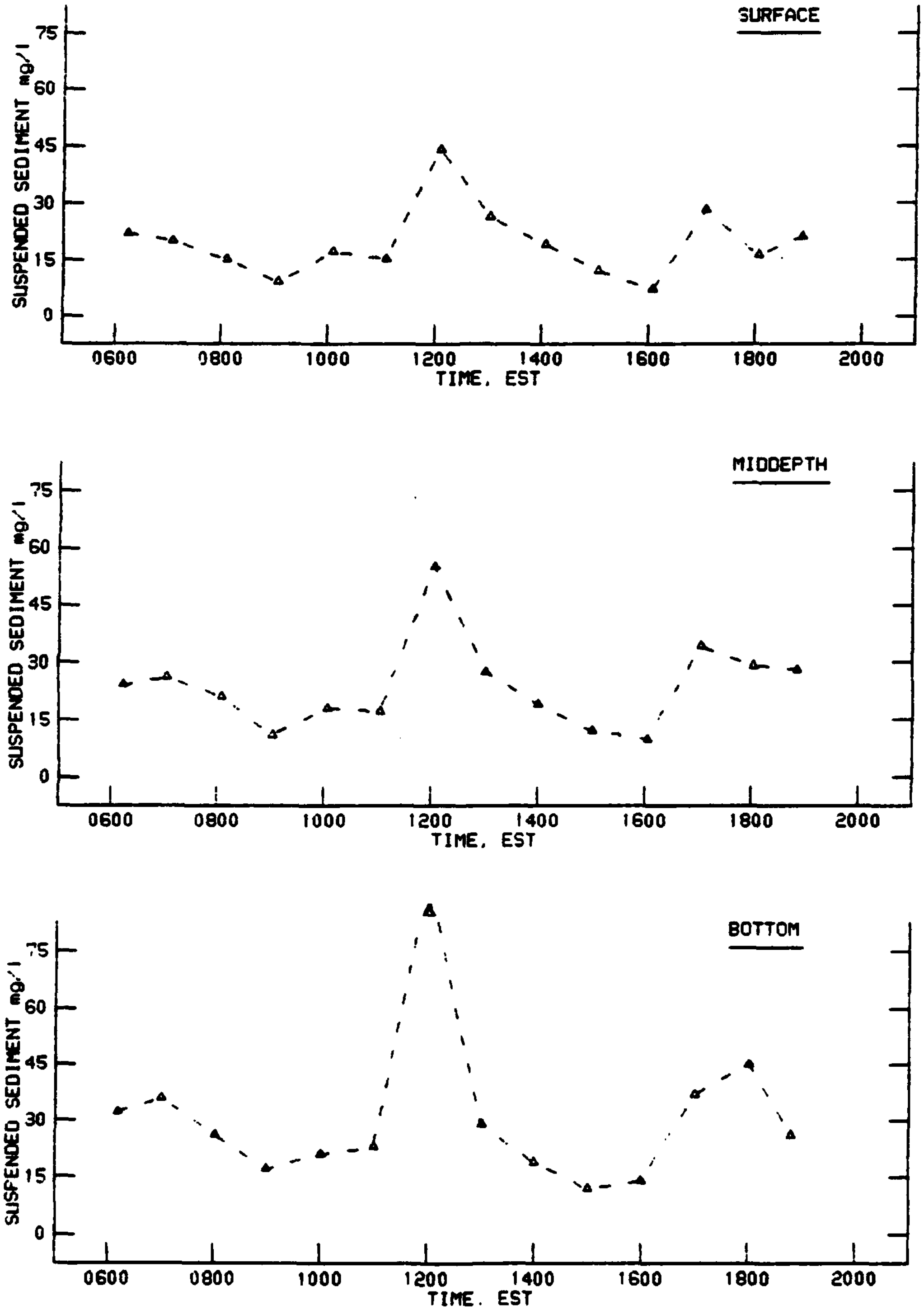
SUSPENDED SEDIMENT AT STATION 7C

8 MAY 1990



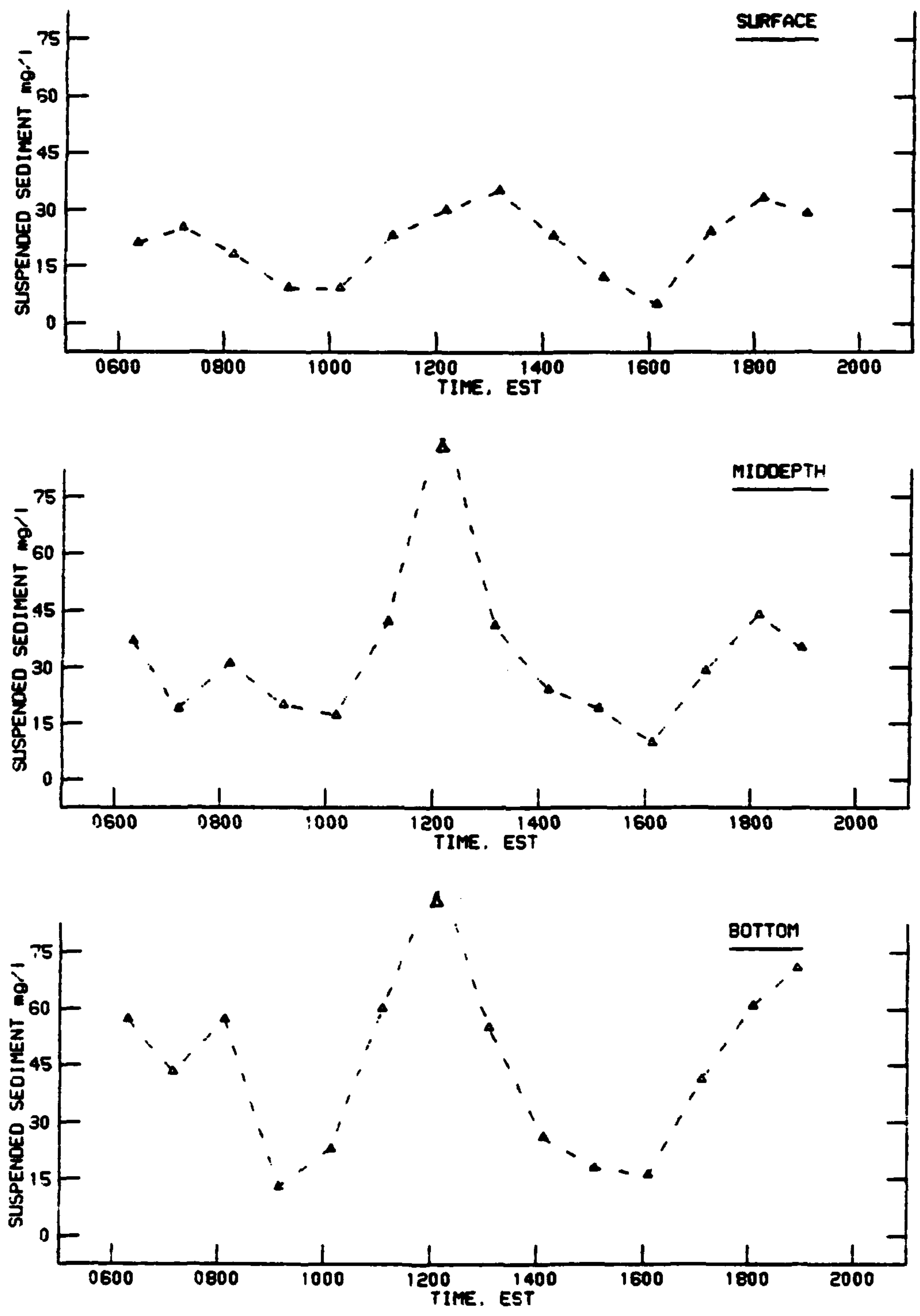
SUSPENDED SEDIMENT AT STATION 7D

8 MAY 1990



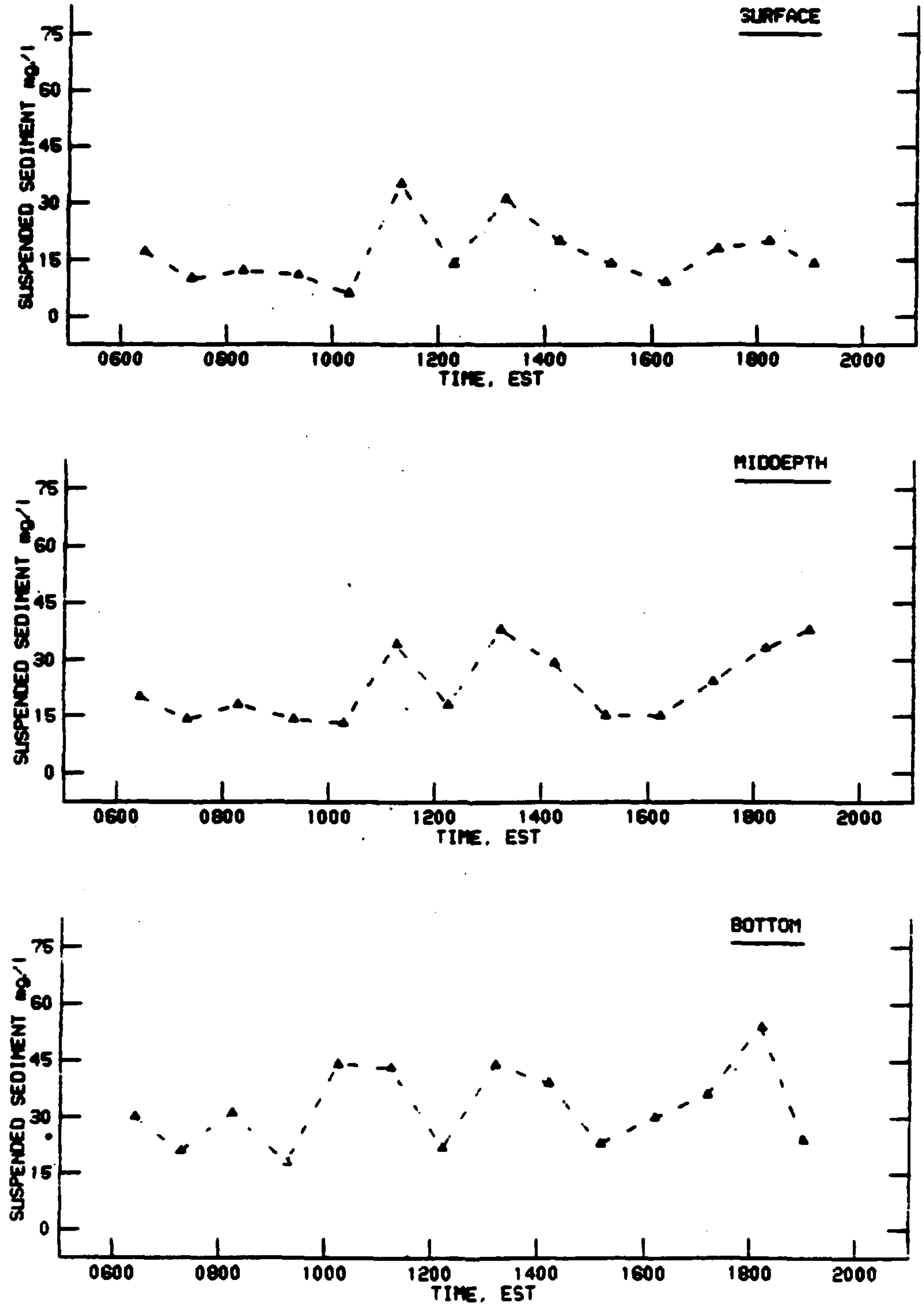
SUSPENDED SEDIMENT AT STATION 8A

8 MAY 1990



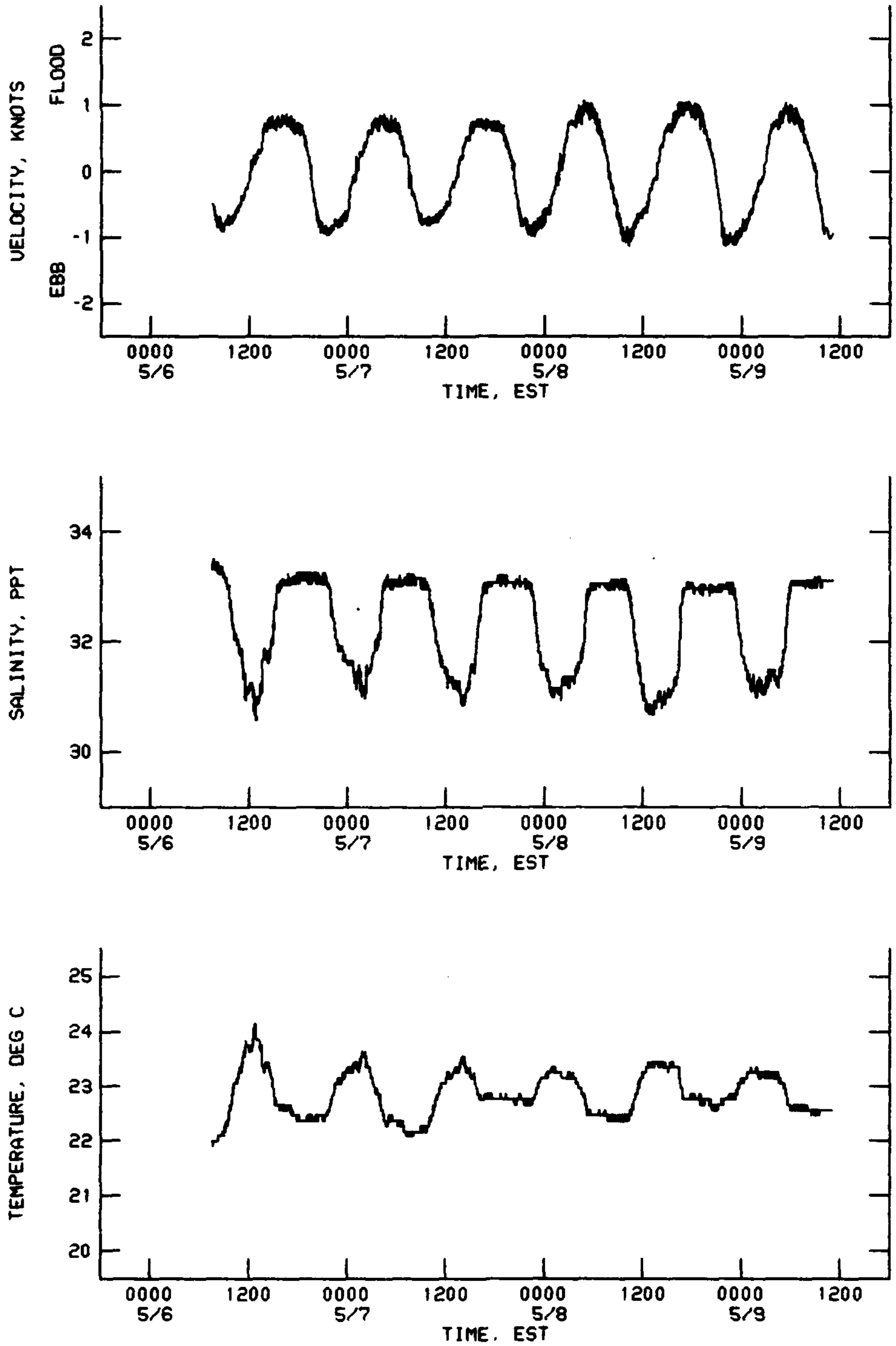
SUSPENDED SEDIMENT AT STATION 8B

8 MAY 1990

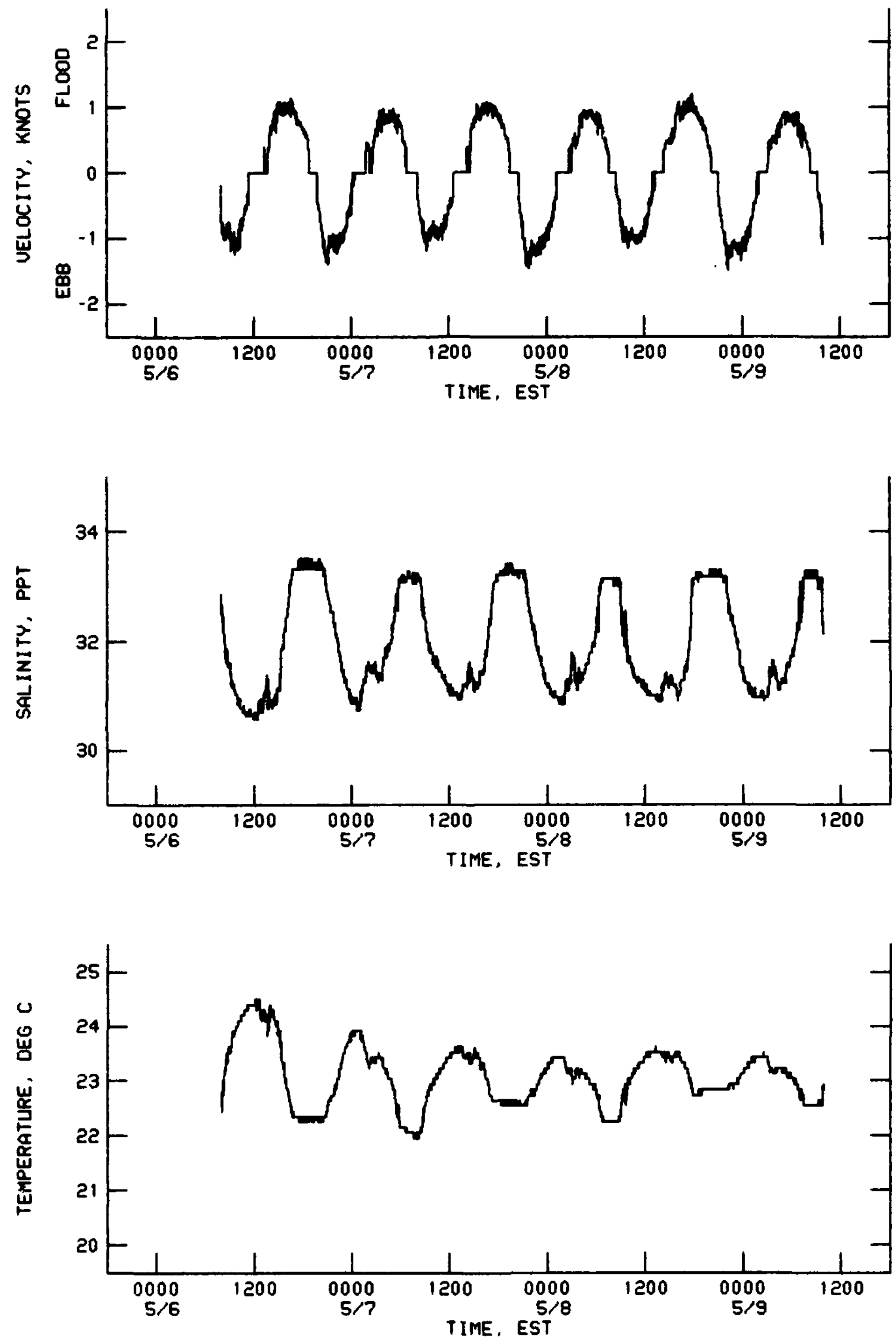


SUSPENDED SEDIMENT AT STATION 8C

8 MAY 1990

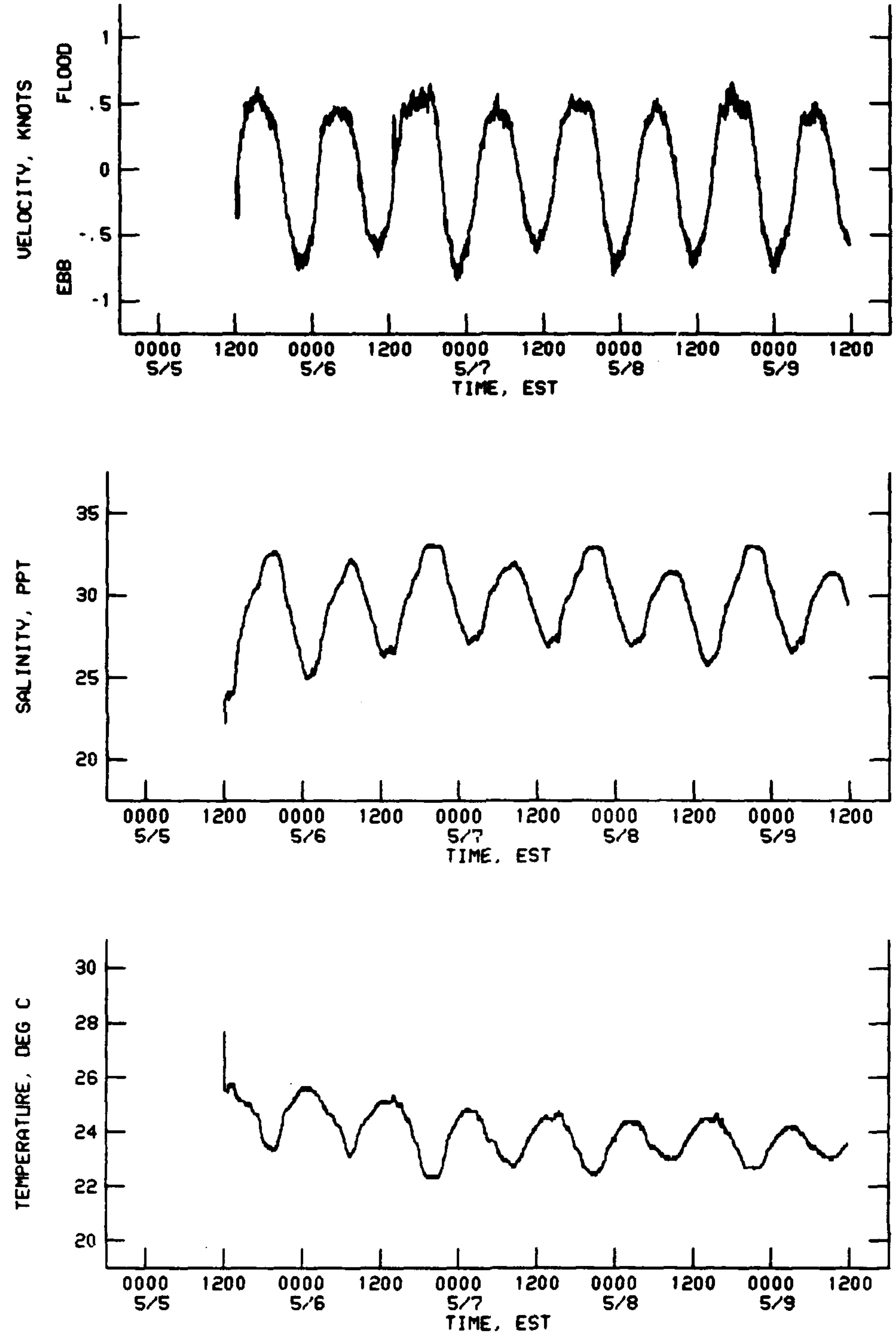


VELOCITY, TEMPERATURE, AND SALINITY AT STATION S1.0
6-9 MAY 1990



VELOCITY, TEMPERATURE, AND SALINITY AT STATION S2.0
6-9 MAY 1990

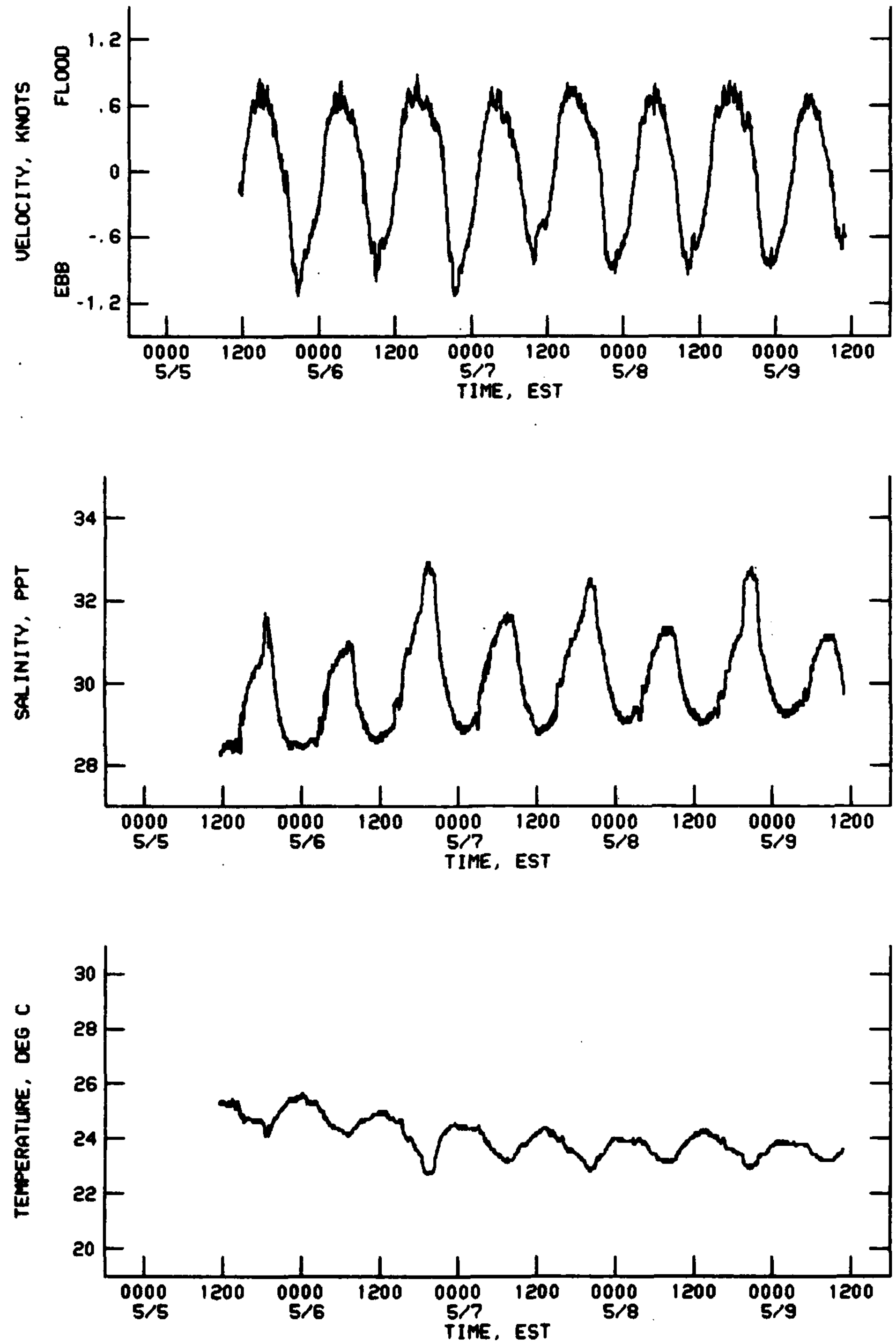
PLATE 94



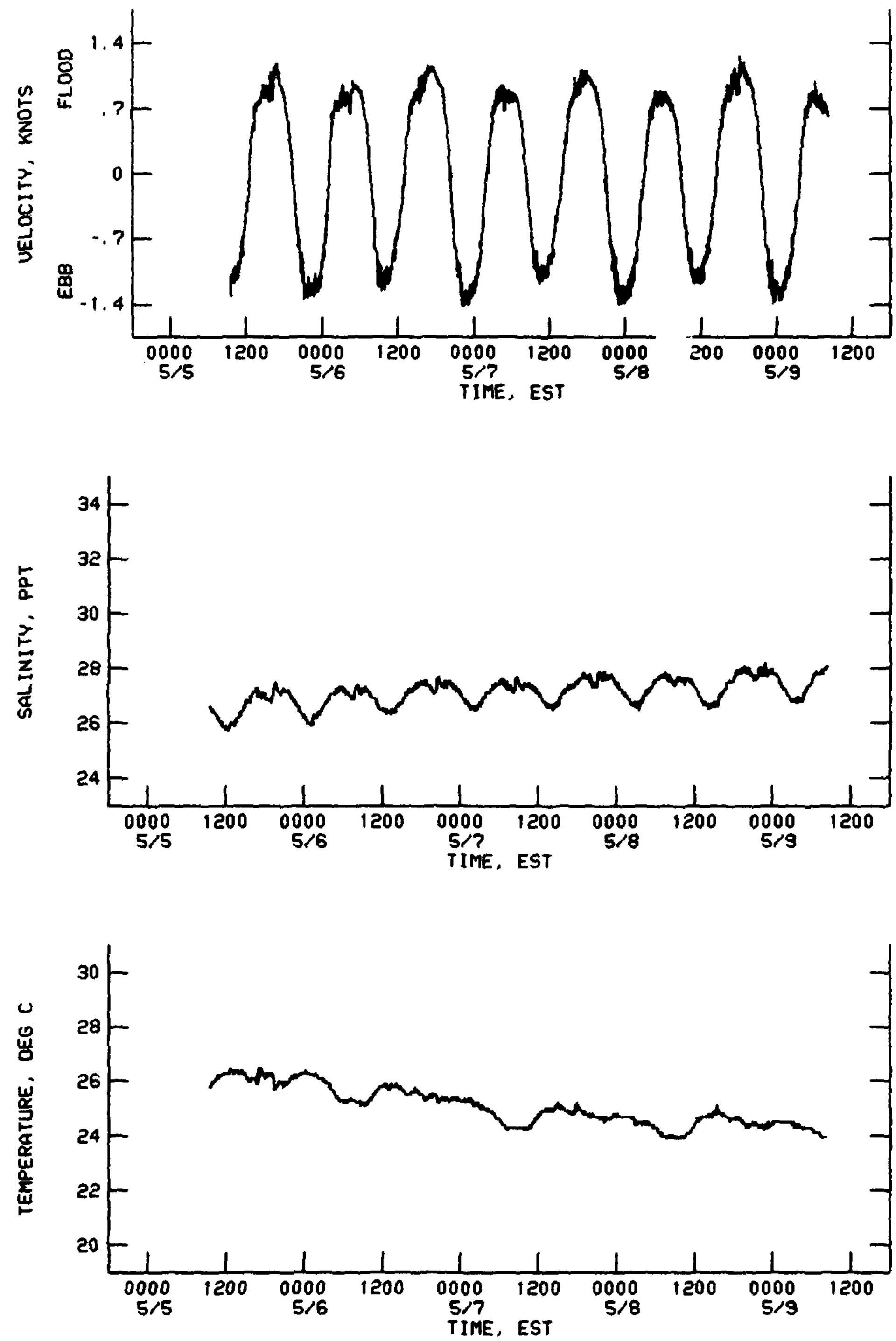
VELOCITY, TEMPERATURE, AND SALINITY AT STATION S3.0

6-9 MAY 1990

PLATE 95



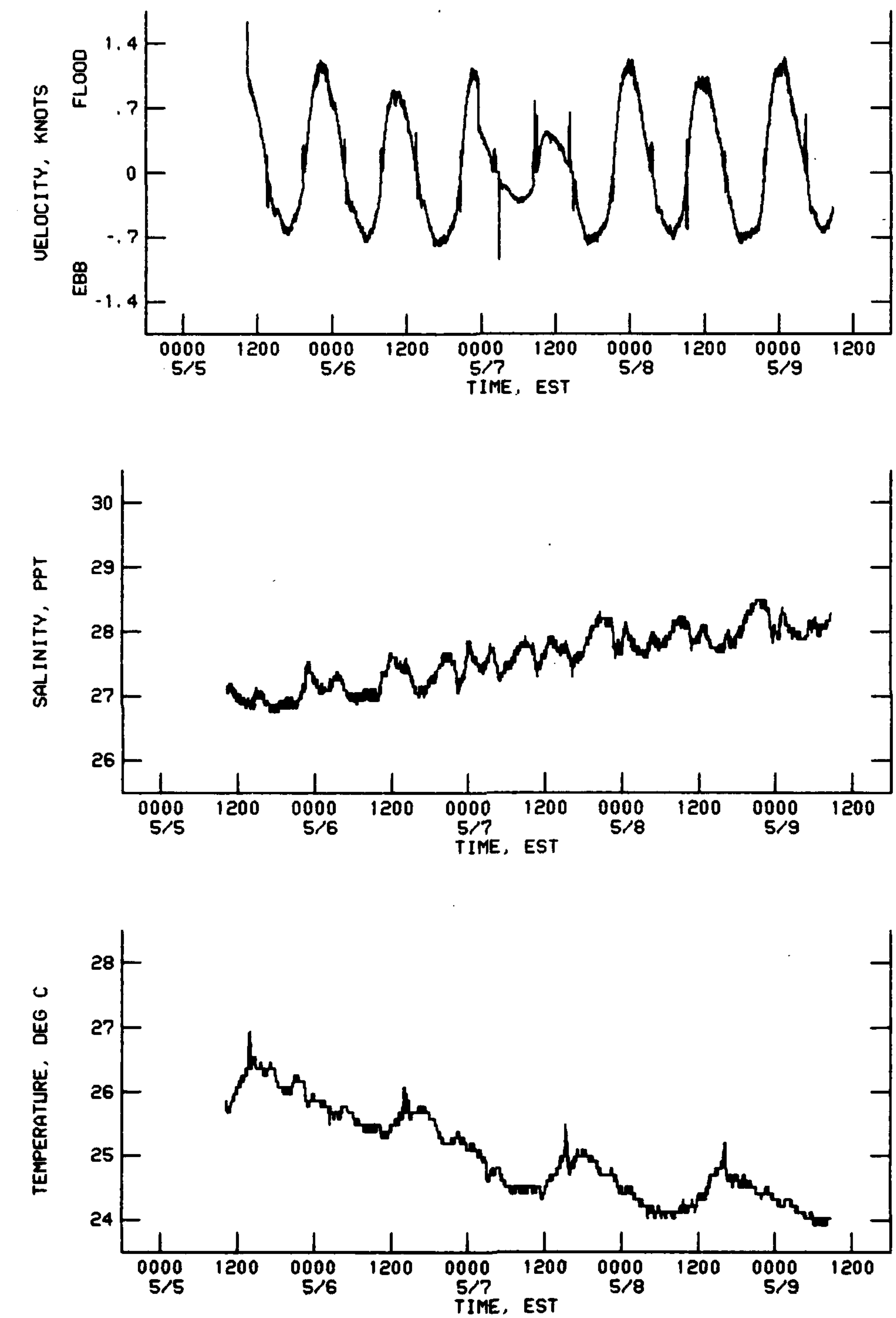
VELOCITY, TEMPERATURE, AND SALINITY AT STATION S4.0
5-9 MAY 1990



VELOCITY, TEMPERATURE, AND SALINITY AT STATION S7.0

5-9 MAY 1990

PLATE 97



VELOCITY, TEMPERATURE, AND SALINITY AT STATION S8.0

5-9 MAY 1990

APPENDIX A: HYDRODYNAMIC DATA

Table A1

Data Observed at Station 1A

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0609	3.0	3.3	94	33.6	10
0704	3.0	1.6	96	33.5	9
0804	3.0	1.7	278	33.1	2
0905	3.0	4.1	278	33.3	5
1004	3.0	3.4	280	33.1	24
1104	3.0	3.7	285	31.5	13
1204	3.0	2.0	302	30.8	9
1304	3.0	0.7	270	30.9	9
1404	3.0	1.5	94	31.0	8
1504	3.0	3.2	96	31.8	15
1605	3.0	3.2	102	33.0	20
1704	3.0	3.5	106	33.8	5
1804	3.0	3.6	104	33.5	8
1904	3.0	2.7	90	33.5	13
			1/4 Depth		
0608	13.5	3.1	110	33.6	13
0703	12.8	1.4	102	33.5	10
0803	12.2	1.6	286	33.4	7
0904	15.1	4.0	274	33.6	21
1003	11.8	3.4	282	33.1	18
1103	11.3	3.4	289	31.6	19
1203	11.0	1.9	296	30.9	7
1303	11.3	1.0	264	30.8	14
1403	11.5	1.5	108	31.3	8
1503	12.4	2.4	104	32.0	38
1604	14.0	3.3	106	33.2	22
1703	14.0	3.4	100	33.8	16
1803	14.0	3.4	102	33.6	9
1903	14.0	2.5	98	33.6	9
			Middepth		
0607	27.0	2.9	110	33.6	15
0702	25.5	1.4	108	33.6	11
0802	24.4	1.3	292	33.4	3
0903	30.3	3.1	278	33.6	11

(Continued)

Note: In Tables A1–A28, data were collected under the following conditions:
Direction - degrees from true north from which the current was flowing.
Surface - measurement obtained 3 ft below water surface.
Bottom - measurement obtained 2 ft above the bed.

Table A1 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1002	23.5	3.4	278	33.1	21
1102	22.5	3.1	272	32.3	32
1202	22.0	2.1	276	31.1	10
1302	22.5	0.8	326	31.0	14
1402	23.0	1.2	108	31.8	10
1502	27.9	2.1	98	32.0	53
1603	28.0	3.4	98	33.2	20
1702	28.0	2.8	98	33.8	20
1802	28.0	3.2	102	33.6	12
1902	28.0	2.1	100	33.6	7
			3/4 Depth		
0606	40.5	2.3	92	33.6	18
0701	38.3	0.9	134	33.6	10
0801	36.6	1.1	308	33.5	7
0901	45.4	2.6	286	33.6	15
1001	35.3	3.4	274	33.1	19
1101	33.8	2.5	266	32.5	41
1201	33.0	2.1	262	31.2	10
1301	33.8	0.5	326	31.3	16
1401	34.5	1.2	98	31.6	8
1501	37.3	1.7	92	32.0	74
1601	42.0	3.3	90	33.2	15
1701	42.0	3.1	98	33.8	14
1801	42.0	2.8	108	33.6	16
1901	42.0	2.1	106	33.6	7
			Bottom		
0604	52.0	2.3	82	33.6	13
0700	49.0	0.7	140	33.4	15
0800	46.7	1.0	304	33.4	4
0900	58.5	2.5	285	33.6	12
1000	45.0	2.1	276	33.1	23
1100	43.0	2.2	280	32.4	146
1200	42.0	1.5	254	31.2	18
1300	43.0	0.6	336	31.5	16
1400	44.0	1.2	338	31.0	10
1500	47.7	1.6	82	32.0	72
1601	54.0	2.6	88	33.2	27
1700	54.0	2.4	90	33.5	16
1800	54.0	2.4	102	33.6	20
1900	54.0	1.5	97	33.5	19

Table A2

Data Observed at Station 1B

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0623	3.0	2.7	98	33.5	10
0716	3.0	1.2	100	33.5	3
0814	3.0	2.0	276	33.5	17
0916	3.0	3.6	272	33.3	7
1017	3.0	4.1	282	32.4	6
1114	3.0	3.5	292	31.3	6
1214	3.0	1.6	306	31.1	12
1312	3.0	0.9	282	30.9	7
1416	3.0	1.2	94	31.0	4
1514	3.0	3.4	92	31.8	6
1615	3.0	3.6	104	33.4	10
1715	3.0	4.3	94	33.9	14
1814	3.0	3.6	97	33.4	10
1913	3.0	2.6	96	33.4	15
			1/4-Depth		
0622	16.5	2.4	94	33.6	12
0715	16.3	1.1	106	33.5	17
0813	15.5	2.2	279	33.5	15
0915	15.5	3.6	274	33.5	9
1016	16.0	3.6	278	32.6	10
1113	14.9	3.0	286	31.5	9
1213	14.5	1.5	284	31.2	13
1311	14.8	1.1	270	31.0	7
1414	15.5	1.4	108	31.1	9
1513	16.1	3.5	96	32.1	19
1614	17.3	3.9	96	33.5	15
1714	17.4	3.8	102	33.9	15
1813	17.5	3.8	98	33.4	11
1912	19.3	2.4	90	33.4	14
			Middepth		
0621	33.0	2.1	90	33.6	12
0714	32.5	1.0	130	33.6	10
0812	31.0	2.0	272	33.4	16
0914	31.0	3.6	276	33.4	7
1015	32.0	3.8	270	32.7	12
1112	29.8	2.9	271	31.9	12
1212	29.0	1.5	276	31.4	18
1310	29.5	1.1	270	31.6	12
1413	31.0	1.1	82	31.8	12

(Continued)

Table A2 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1512	32.3	2.9	96	32.2	34
1612	34.5	3.5	96	33.5	10
1713	34.8	3.5	92	33.8	13
1812	35.0	3.1	102	33.4	12
1911	33.5	2.4	98	33.4	12
			3/4 Depth		
0620	49.5	1.5	94	33.6	10
0712	48.8	1.1	134	33.6	10
0811	46.5	1.6	276	33.5	17
0913	46.5	3.6	290	33.5	7
1014	48.0	3.3	272	32.8	12
1111	44.7	2.4	262	31.9	21
1211	43.5	1.6	252	31.7	22
1309	44.3	0.7	290	31.4	11
1412	46.5	1.0	94	31.9	24
1511	48.4	2.4	94	32.2	41
1611	51.8	3.2	87	33.5	12
1711	52.2	3.8	102	33.8	15
1811	52.5	2.5	99	33.4	16
1910	52.8	1.5	98	33.4	12
			Bottom		
0619	64.0	1.4	105	33.6	11
0711	63.0	0.7	144	33.6	12
0810	60.0	0.9	282	33.3	16
0912	60.0	3.2	290	33.3	9
1013	62.0	2.1	302	32.8	12
1110	57.5	1.6	260	31.9	25
1210	56.0	1.0	250	32.0	37
1308	57.0	1.2	330	31.8	21
1411	60.0	0.9	91	31.9	31
1510	62.5	1.3	86	32.2	30
1610	67.0	2.6	86	33.5	11
1710	67.5	1.5	94	33.7	15
1810	68.0	1.9	100	33.4	10
1909	65.0	1.9	88	33.4	11

Table A3

Data Observed at Station 1C

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0635	3.0	1.6	90	33.4	9
0728	3.0	1.1	82	33.5	7
0824	3.0	2.4	285	33.5	5
0926	3.0	3.5	278	33.4	10
1027	3.0	3.8	276	32.4	12
1124	3.0	3.0	280	31.4	10
1224	3.0	1.6	288	31.3	15
1324	3.0	1.0	252	31.2	5
1425	3.0	1.1	94	31.0	4
1524	3.0	3.3	92	32.0	18
1624	3.0	3.9	92	33.6	15
1727	3.0	3.1	98	33.5	12
1824	3.0	3.0	97	33.4	8
1922	3.0	1.7	104	33.5	7
			1/4 Depth		
0634	15.7	1.8	94	33.4	14
0726	16.3	1.0	80	33.4	12
0823	14.7	2.1	276	33.5	9
0925	14.8	3.2	276	33.5	9
1026	14.3	2.9	282	32.6	15
1123	14.0	2.7	280	31.5	9
1223	13.8	1.3	271	31.4	13
1323	14.9	1.1	250	31.2	5
1424	13.9	1.1	96	31.5	5
1523	14.5	2.8	96	32.1	22
1623	15.1	3.2	92	33.6	12
1726	15.3	3.2	88	33.5	20
1823	15.3	2.4	102	33.5	10
1921	14.5	1.6	91	33.5	7
			Middepth		
0632	31.3	1.6	112	33.5	13
0725	32.8	1.0	122	33.5	27
0822	29.3	1.5	266	33.6	10
0924	29.5	3.1	274	33.5	12
1024	28.5	2.3	274	32.8	13
1122	28.0	2.3	267	31.7	10
1222	27.5	1.1	250	31.5	16
1322	29.8	1.1	248	31.7	10
1423	27.8	1.4	102	31.7	14

(Continued)

Table A3 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1522	29.0	2.4	98	32.1	24
1622	30.3	3.2	84	33.6	16
1725	30.5	3.0	96	33.5	19
1822	30.5	2.5	102	33.5	12
1920	29.0	1.7	96	33.5	7
			3/4 Depth		
0631	47.0	1.5	104	33.5	17
0723	49.1	0.9	146	33.5	8
0821	44.0	1.8	260	33.6	12
0923	44.3	3.1	270	33.5	13
1024	42.8	2.0	262	32.8	14
1121	42.0	2.0	266	31.8	12
1221	41.3	1.1	248	31.8	17
1321	44.7	0.5	246	31.8	11
1422	41.7	1.3	101	31.7	44
1521	43.5	1.9	98	32.1	28
1621	45.4	2.8	92	33.6	20
1723	45.8	2.2	94	33.6	18
1821	45.8	2.6	94	33.5	10
1919	43.5	1.5	104	33.5	8
			Bottom		
0630	60.5	1.3	114	33.5	19
0722	63.5	0.8	142	33.5	10
0820	65.6	1.3	284	33.6	14
0922	57.0	2.1	264	33.5	15
1023	55.0	1.4	264	32.6	16
1120	54.0	1.5	266	31.9	12
1220	53.0	0.7	310	31.8	25
1320	57.5	0.4	250	31.7	11
1421	53.5	1.0	62	31.7	42
1520	56.0	1.6	100	31.4	5
1620	58.5	2.4	84	33.5	29
1722	59.0	1.5	100	33.8	27
1820	59.0	2.2	100	33.5	10
1918	56.0	1.5	94	33.4	8

Table A4

Data Observed at Station 1D

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0647	3.0	1.0	106	33.4	11
0739	3.0	0.9	288	33.4	11
0835	3.0	2.9	281	33.5	8
0937	3.0	3.1	276	33.5	22
1036	3.0	3.6	278	32.6	122
1133	3.0	2.3	282	31.8	23
1233	3.0	1.8	274	31.1	7
1333	3.0	1.2	332	31.2	5
1435	3.0	1.6	100	31.2	5
1533	3.0	2.3	94	31.9	21
1633	3.0	2.7	94	33.5	12
1736	3.0	2.2	96	33.5	26
1833	3.0	1.5	78	33.4	18
1930	3.0	0.5	100	33.6	10
			1/4 Depth		
0646	9.4	0.9	106	33.4	20
0738	10.0	0.9	290	33.3	18
0834	10.0	2.7	274	33.6	26
0936	9.6	3.1	271	33.5	24
1035	9.1	3.5	274	32.7	125
1132	9.0	2.4	276	32.0	23
1232	9.0	1.9	264	31.3	9
1332	9.5	0.6	320	31.6	9
1434	8.3	1.3	100	31.3	6
1532	8.8	2.4	92	31.9	22
1632	9.0	2.6	96	33.5	11
1735	9.4	2.4	98	33.2	17
1832	9.5	1.7	90	33.4	15
1929	9.3	0.8	86	33.5	13
			Middepth		
0645	18.7	0.8	122	33.4	22
0737	20.0	0.9	280	33.4	6
0833	20.0	2.4	273	33.6	31
0935	19.2	2.3	288	33.5	24
1034	18.2	2.7	267	32.8	124
1131	18.0	2.2	270	32.1	29
1231	18.0	1.3	268	31.8	16
1331	19.0	0.9	310	31.7	13
1433	16.5	1.3	109	31.5	9

(Continued)

Table A4 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1531	17.5	2.1	96	32.0	21
1631	18.0	2.6	110	33.5	15
1734	18.8	2.3	102	33.5	17
1831	19.0	1.7	100	33.5	13
1928	18.5	0.8	90	33.5	14
			3/4 Depth		
0644	28.1	0.7	112	33.3	22
0736	30.0	0.8	276	33.4	22
0832	30.0	2.1	270	33.6	36
0934	28.8	2.0	270	33.5	24
1033	27.3	2.4	261	32.9	122
1130	27.0	1.4	262	32.1	27
1230	27.0	0.9	264	31.9	22
1330	28.5	0.8	256	31.8	33
1432	24.8	1.2	92	31.6	20
1530	26.3	1.9	98	32.0	25
1630	27.0	2.1	110	33.5	25
1733	28.2	2.5	100	33.5	15
1830	28.5	1.8	112	33.5	13
1927	35.0	0.9	100	33.5	18
			Bottom		
0643	35.5	0.8	112	33.3	26
0735	38.0	0.5	62	33.4	15
0831	38.0	1.1	264	33.5	6
0933	36.4	1.0	268	33.5	24
1032	34.4	1.4	262	32.7	21
1129	34.0	1.4	252	32.1	25
1229	34.0	0.9	290	32.0	34
1329	36.0	0.8	254	31.8	33
1431	31.0	1.0	90	31.4	29
1529	33.0	1.6	96	32.0	24
1629	34.0	2.2	106	33.6	12
1731	35.5	1.5	100	33.5	15
1829	36.0	1.5	108	33.5	9
1926	35.0	0.9	100	33.5	10

Table A5

Data Observed at Station 2A

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0623	3.0	0.8	26	32.4	11
0718	3.0	0.2	72	33.4	6
0820	3.0	1.6	234	32.7	7
0918	3.0	2.2	242	32.2	14
1016	3.0	1.6	242	31.9	8
1117	3.0	1.8	244	31.6	17
1219	3.0	1.2	230	31.3	16
1318	3.0	0.3	324	31.0	7
1423	3.0	0.9	30	31.3	10
1523	3.0	1.6	20	31.3	5
1620	3.0	2.4	22	31.4	8
1718	3.0	1.8	34	32.2	23
1817	3.0	1.5	29	33.1	24
1918	3.0	1.0	30	33.4	2
			1/4 Depth		
0622	12.6	1.3	20	33.1	16
0717	12.7	0.4	24	33.4	19
0819	11.8	1.6	238	33.2	6
0917	11.7	1.8	236	32.4	22
1015	11.3	1.9	232	31.9	6
1116	11.0	1.7	252	31.6	19
1218	10.4	1.2	198	31.4	23
1317	10.3	0.6	254	31.2	13
1422	11.3	0.9	30	31.4	12
1522	11.8	2.0	24	31.3	9
1619	12.2	2.4	18	--*	--*
1717	12.5	1.9	24	32.4	25
1816	12.7	1.9	19	33.5	21
1917	12.7	1.3	26	33.6	4
			Middepth		
0621	25.1	1.4	20	33.3	20
0716	25.5	0.6	28	33.4	12
0818	23.5	1.2	254	33.4	11
0916	23.4	1.2	220	32.6	20
1014	22.6	1.5	248	31.9	29
1115	22.1	1.7	232	31.6	18
1217	20.9	0.9	202	31.4	23

(Continued)

* No sample collected.

Table A5 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1316	20.6	0.8	236	31.8	16
1421	22.7	1.1	10	31.4	9
1520	23.7	1.8	26	31.5	10
1618	24.4	2.3	10	31.4	8
1716	25.0	2.5	12	32.6	21
1815	25.3	1.8	18	33.5	26
1916	25.4	1.5	14	33.6	10
			3/4 Depth		
0619	37.7	1.4	20	33.3	27
0715	38.2	0.6	32	33.5	14
0817	35.3	0.9	248		7
0915	35.1	1.2	228	33.0	15
1013	33.9	1.6	212	31.9	8
1114	33.2	1.4	214	31.7	22
1216	31.3	0.5	248	31.4	23
1315	30.9	1.0	250	31.2	15
1419	34.0	0.9	5	31.4	15
1519	35.6	1.3	30	31.6	11
1607	36.6	2.0	20	— *	— *
1715	37.5	2.1	18	32.7	32
1814	38.0	1.8	16	33.5	27
1915	38.1	1.3	9	33.7	25
			Bottom		
0618	48.2	0.7	34	33.4	31
0714	49.0	0.6	34	33.5	10
0816	45.0	0.4	250	33.5	11
0914	44.8	0.5	190	33.3	29
1012	43.2	0.3	224	32.0	11
1113	42.2	0.6	182	31.7	22
1215	39.8	1.0	244	31.4	25
1314	39.1	0.9	120	31.3	20
1416	43.4	0.4	342	31.5	25
1517	45.4	0.9	36	31.7	17
1616	46.8	1.3	21	31.6	24
1713	48.0	1.3	19	32.6	25
1813	48.6	1.1	18	33.4	45
1914	48.8	0.7	15	33.6	40

* No sample collected.

Table A6

Data Observed at Station 2B

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0614	3.0	1.0	22	32.6	7
0711	3.0	0.8	16	33.4	4
0812	3.0	1.0	224	32.2	6
0911	3.0	2.8	238	32.2	10
1009	3.0	2.0	240	32.0	11
1109	3.0	1.6	228	31.6	21
1211	3.0	0.7	220	31.4	19
1310	3.0	0.4	262	31.0	14
1413	3.0	0.5	42	31.1	6
1514	3.0	2.0	14	31.1	5
1613	3.0	2.4	10	31.5	13
1710	3.0	2.4	24	32.2	14
1809	3.0	2.3	18	33.3	14
1912	3.0	1.7	26	33.5	10
			1/4 Depth		
0613	10.5	1.7	18	32.8	6
0710	10.5	1.0	10	33.5	10
0811	10.0	0.8	252	33.4	3
0910	10.7	2.2	242	32.5	14
1008	10.3	2.4	230	32.0	12
1108	9.9	1.6	232	31.6	23
1210	9.6	1.0	240	31.4	24
1309	8.8	0.6	270	31.3	12
1412	9.2	0.6	14	31.3	10
1512	9.2	1.9	14	31.3	7
1612	9.7	1.9	20	__*	__*
1709	9.8	2.3	20	32.4	22
1808	10.2	2.3	18	33.4	10
1911	9.8	1.6	18	33.6	10
			Middepth		
0612	21.0	1.8	16	33.2	13
0709	21.0	0.8	10	33.4	11
0810	10.0	0.8	252	33.4	3
0909	21.4	1.6	242	33.0	16
1007	20.6	1.7	246	32.1	15
1107	19.8	1.8	238	31.7	23
1209	19.2	0.8	222	31.4	27

(Continued)

* No sample collected.

Table A6 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1308	17.6	0.5	288	31.3	16
1411	18.4	0.6	14	31.3	9
1511	18.3	2.2	18	31.6	8
1611	19.5	2.1	14	31.7	23
1708	19.7	2.3	20	32.5	43
1807	20.4	2.2	22	33.4	14
1908	19.7	1.7	20	33.6	18
			3/4 Depth		
0610	31.5	1.3	18	33.3	30
0708	31.5	0.6	16	33.4	15
0808	30.0	0.9	210	33.4	5
0908	32.1	0.8	238	33.1	19
1006	30.9	1.8	234	32.1	10
1106	29.7	1.5	240	31.7	26
1208	28.7	0.7	236	31.4	34
1307	26.4	0.7	202	31.3	28
1410	34.0	0.9	5	31.4	6
1510	27.5	1.3	17	31.9	16
1610	29.3	1.8	22	31.7	25
1707	29.5	2.0	19	32.4	47
1806	30.6	2.1	14	33.4	24
1907	29.5	1.6	16	33.6	16
			Bottom		
0609	40.0	1.2	20	33.3	29
0707	40.0	0.5	18	33.4	13
0807	38.0	0.9	210	33.4	12
0907	40.8	0.5	252	33.2	20
1005	39.1	0.6	258	32.1	16
1105	37.6	0.8	244	31.7	29
1207	36.3	0.6	216	31.4	50
1306	33.3	0.1	270	31.4	38
1408	34.8	0.5	0	31.5	23
1508	34.7	0.7	20	31.9	28
1609	37.0	1.2	26	31.7	21
1706	37.4	1.6	20	32.4	54
1805	38.8	0.9	16	33.4	42
1906	39.4	0.6	14	33.6	38

Table A7

Data Observed at Station 2C

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0604	3.0	1.5	18	33.0	17
0703	3.0	1.3	20	33.3	12
0802	3.0	0.9	280	33.2	5
0902	3.0	2.4	228	32.6	8
1002	3.0	2.7	238	32.1	20
1102	3.0	2.3	234	31.7	22
1202	3.0	1.0	234	31.4	20
1302	3.0	0.3	272	31.3	11
1403	3.0	0.5	10	31.1	6
1503	3.0	1.3	19	31.1	12
1603	3.0	1.6	20	31.2	21
1702	3.0	2.4	20	32.1	30
1802	3.0	1.9	18	33.2	16
1902	3.0	2.0	26	33.6	14
			Middepth		
0602	13.7	1.1	24	33.0	27
0701	14.2	0.9	22	33.4	8
0801	14.2	1.0	250	33.4	7
0901	13.1	2.3	240	32.9	12
1001	12.6	2.2	242	32.3	35
1101	11.7	2.2	240	31.8	33
1201	11.1	0.9	230	31.5	28
1301	11.6	0.2	348	31.4	17
1402	11.9	0.4	2	31.3	7
1502	12.7	1.4	13	31.6	13
1602	13.4	1.6	16	31.4	19
1701	14.0	1.9	16	32.0	32
1801	14.3	1.5	19	33.2	18
1901	14.4	1.4	30	33.6	13
			Bottom		
0600	25.5	1.0	16	33.1	41
0700	26.5	0.4	26	33.3	8
0800	26.4	0.3	232	33.4	7
0900	24.2	1.0	240	33.1	32
1000	23.1	1.3	238	32.4	46
1100	21.5	0.7	192	32.0	47
1200	20.2	0.5	254	31.6	76
1300	21.2	0.1	168	31.5	34
1400	21.8	0.3	14	31.5	12

(Continued)

Table A7 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1500	23.4	0.4	15	31.6	29
1600	24.8	1.2	12	31.7	32
1700	26.0	1.4	24	32.0	30
1800	26.6	1.4	18	33.3	22
1900	26.8	1.1	18	33.6	20

Table A8

Data Observed at Station 3A

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0612	3.0	1.8	110	31.9	17
0704	3.0	1.2	110	32.2	16
0804	3.0	0.6	100	32.5	6
0907	3.0	1.5	297	32.1	5
1004	3.0	2.2	296	31.2	9
1104	3.0	2.2	294	30.2	16
1204	3.0	1.8	300	29.0	14
1304	3.0	1.4	302	27.1	9
1404	3.0	1.1	330	26.4	3
1504	3.0	1.0	100	26.8	6
1604	3.0	2.4	110	29.3	3
1704	3.0	2.0	110	30.8	24
1804	3.0	2.1	104	31.8	11
1852	3.0	2.2	108	32.7	10
			Middepth		
0611	12.0	1.6	110	31.9	24
0702	10.1	1.1	110	32.2	18
0802	16.3	0.6	130	33.0	14
0905	14.0	1.4	278	32.2	8
1002	13.8	1.9	290	31.5	23
1102	12.6	1.6	292	30.4	26
1202	12.7	1.6	285	29.5	20
1302	12.1	1.0	296	27.8	11
1402	11.8	0.8	340	26.6	6
1502	9.3	1.2	104	28.0	7
1602	11.3	1.8	106	30.0	16
1702	12.0	1.6	110	30.8	36
1802	12.7	2.0	102	31.7	16
1850	12.7	1.9	106	32.7	12
			Bottom		
0610	22.0	0.8	110	31.9	33
0700	18.2	1.3	98	32.2	24
0800	22.1	0.6	90	33.2	17
0903	26.0	1.0	280	32.8	15
1000	25.5	1.3	280	31.6	61
1100	24.3	1.4	286	30.6	38
1200	23.4	0.9	275	30.0	33
1300	22.2	0.9	280	28.5	16
1400	21.7	0.5	158	28.0	8

(Continued)

Table A8 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1500	18.7	0.8	110	28.7	40
1600	20.5	1.2	108	30.1	29
1700	22.1	1.4	102	30.8	43
1800	23.4	1.8	98	31.7	22
1848	23.3	1.6	102	32.8	19

Table A9

Data Observed at Station 3B

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0623	3.0	1.3	119	31.8	17
0712	3.0	0.8	116	32.3	12
0812	3.0	0.6	50	32.3	6
0914	3.0	1.6	300	32.0	7
1011	3.0	2.4	290	31.0	16
1111	3.0	2.1	298	29.9	18
1213	3.0	1.8	300	28.4	14
1312	3.0	1.2	308	27.3	12
1412	3.0	0.6	338	26.7	5
1512	3.0	1.2	90	27.2	7
1610	3.0	1.6	116	29.9	27
1710	3.0	1.8	118	30.7	36
1812	3.0	1.9	116	31.8	14
1859	3.0	1.4	120	32.8	9
			Middepth		
0622	11.3	1.3	118	31.8	18
0710	12.9	0.9	132	32.2	16
0810	12.5	0.5	128	32.5	9
0912	10.3	1.5	292	32.2	11
1009	9.8	1.8	296	31.2	25
1110	9.1	2.0	298	30.0	19
1211	8.7	1.5	290	28.7	19
1310	8.9	0.8	296	27.9	16
1410	8.9	0.8	300	27.0	8
1510	9.8	1.4	126	28.3	9
1608	9.3	1.4	118	29.9	42
1708	11.3	1.6	110	30.7	58
1810	11.7	2.0	115	31.8	13
1857	11.8	1.7	114	32.8	11
			Bottom		
0620	20.5	1.0	108	31.8	20
0708	23.8	0.7	140	32.3	20
0808	23.0	0.3	202	33.1	11
0910	18.6	0.8	274	32.2	22
1007	17.5	1.2	280	31.4	32
1108	16.2	1.4	290	30.2	23
1209	15.5	1.0	280	28.7	20
1308	15.9	0.8	216	28.8	27
1408	15.8	0.8	288	27.2	7

(Continued)

Table 9 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1508	17.6	0.8	132	28.6	45
1606	18.7	1.0	134	30.0	58
1706	20.7	1.0	120	30.8	66
1808	21.5	1.8	114	31.8	15
1855	21.7	1.4	102	32.8	14

Table A10

Data Observed at Station 3C

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0632	3.0	1.2	94	31.9	15
0719	3.0	0.8	126	32.2	11
0824	3.0	0.4	5	32.3	4
0920	3.0	1.8	298	32.1	7
1021	3.0	2.6	288	—*	12
1120	3.0	2.2	300	29.7	16
1222	3.0	2.0	300	28.2	14
1320	3.0	1.4	302	27.1	3
1422	3.0	0.4	50	27.1	7
1518	3.0	1.4	112	—*	5
1618	3.0	2.0	110	30.1	14
1716	3.0	1.7	108	30.8	31
1817	3.0	1.6	118	31.9	21
1907	3.0	1.8	110	33.1	11
			Middepth		
0630	11.3	0.9	101	31.9	17
0717	12.0	0.8	128	32.3	13
0822	12.5	0.2	236	32.7	6
0918	11.7	1.4	292	32.2	15
1017	10.9	1.9	282	31.3	23
1118	10.1	2.0	292	30.0	21
1220	10.0	1.5	292	28.5	19
1318	10.0	0.9	294	27.6	13
1420	8.5	0.8	164	27.5	6
1516	10.5	1.5	130	27.7	6
1616	11.3	2.0	112	30.0	18
1714	11.8	1.6	122	30.8	30
1815	12.2	1.4	120	31.8	22
1905	12.8	1.4	120	33.1	11
			Bottom		
0628	20.5	0.9	98	32.0	40
0715	22.0	0.6	120	32.3	17
0820	23.1	0.5	92	33.1	7
0916	21.4	1.0	270	32.2	44
1015	19.7	1.2	282	31.3	39
1616	18.2	1.5	284	30.0	23
1219	18.0	1.0	290	28.7	27

(Continued)

* No sample collected.

Table A10 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1316	17.9	0.4	272	27.8	18
1418	17.0	0.5	84	28.1	8
1514	18.9	0.8	122	28.1	28
1614	20.5	1.5	112	30.0	24
1712	21.6	1.0	122	30.8	30
1813	22.4	1.3	102	32.0	30
1903	23.7	1.0	98	33.0	17

Table A11

Data Observed at Station 4A

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0622	3.0	1.1	180	31.0	11
0703	3.0	1.0	240	31.3	11
0802	3.0	2.0	340	30.1	5
0903	3.0	3.0	355	29.6	4
1002	3.0	2.4	350	29.7	13
1102	3.0	2.1	340	28.9	18
1202	3.0	1.1	350	28.4	14
1302	3.0	0.3	350	28.5	8
1402	3.0	0.6	170	28.5	3
1502	3.0	1.6	160	28.7	7
1602	3.0	1.8	175	29.3	18
1702	3.0	1.4	175	30.0	18
1802	3.0	1.3	180	30.8	15
1857	3.0	0.8	165	31.6	12
			Middepth		
0620	13.5	1.0	170	31.2	13
0702	12.5	1.2	200	31.6	16
0801	12.0	1.2	10	31.9	9
0902	12.0	2	0	31.0	22
1001	11.0	2.2	350	30.0	13
1101	10.5	1.6	0	29.0	15
1201	10.0	1.0	355	28.4	20
1301	9.5	0.9	70	28.5	3
1401	10.0	0.6	175	28.5	4
1501	10.0	1.3	175	28.7	6
1601	11.0	1.5	165	29.3	10
1701	12.0	1.5	160	30.3	28
1801	12.0	1.4	180	31.2	19
1856	11.0	1.1	180	31.8	24
			Bottom		
0620	25.0	1.1	140	31.6	30
0700	23.0	1.0	60	31.8	20
0800	22.0	0.8	0	31.9	9
0900	22.0	1.0	340	31.7	49
1000	20.0	1.6	0	30.0	20
1100	19.0	1.0	340	29.0	20
1200	18.0	0.8	310	28.5	25
1300	17.0	0.3	10	28.7	4
1400	18.0	0.5	210	28.6	8

(Continued)

Table A11 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
		Bottom (Continued)			
1500	18.0	1.2	180	28.8	20
1600	20.0	1.1	160	29.3	10
1700	22.0	1.0	160	30.3	58
1800	22.0	1.2	170	31.2	29
1855	20.0	0.8	170	31.9	23

Table A12

Data Observed at Station 4B

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0628	3.0	1.4	220	31.0	5
0170	3.0	1.0	260	31.2	7
0808	3.0	2.0	340	30.0	8
0909	3.0	3.1	340	29.5	4
1007	3.0	3.2	340	29.9	8
1108	3.0	2.4	345	28.9	8
1207	3.0	1.8	340	28.5	11
1308	3.0	0.7	340	28.5	6
1408	3.0	1.1	180	28.5	8
1508	3.0	1.6	160	28.7	3
1607	3.0	1.9	170	29.4	9
1708	3.0	1.5	180	29.8	9
1807	3.0	1.5	195	30.7	9
1906	3.0	1.2	200	31.5	9
			Middepth		
0627	15.5	1.8	175	31.3	9
0708	12.5	0.6	120	31.7	7
0807	15.0	1.0	330	31.7	6
0908	14.0	2.3	340	30.5	9
1006	13.5	2.0	340	30.1	13
1107	13.0	2.5	340	29.0	12
1206	10.0	1.3	350	28.5	11
1307	12.0	0.4	340	28.5	5
1407	12.0	1.4	185	28.6	5
1507	13.0	1.6	175	28.7	5
1606	14.0	1.4	180	29.5	8
1707	14.5	1.7	175	30.7	24
1806	15.0	1.4	170	31.3	14
1905	15.0	1.3	190	31.9	12
			Bottom		
0625	29.0	1.5	150	31.8	24
0707	23.0	1.9	180	31.8	3
0806	28.0	0.5	300	32.0	7
0907	26.0	1.1	327	31.8	14
1005	25.0	1.0	355	30.8	22
1106	24.0	1.8	350	29.0	15
1205	18.0	1.2	340	28.7	14
1306	22.0	0.5	300	29.4	11
1406	22.0	1.0	190	29.3	19

(Continued)

Table A12 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1505	24.0	1.1	150	29.2	23
1605	26.0	0.9	150	29.9	22
1706	27.0	1.1	135	31.0	24
1805	28.0	1.2	180	31.5	42
1903	28.0	1.0	190	31.8	16

Table A13

Data Observed at Station 4C

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0642	3.0	1.4	240	31.1	2
0718	3.0	0.2	30	31.3	5
0817	3.0	2.2	340	29.9	5
0919	3.0	3.2	345	29.6	8
1016	3.0	2.5	355	29.7	3
1120	3.0	2.2	360	29.0	9
1215	3.0	1.6	340	28.6	4
1317	3.0	0.6	345	28.5	5
1415	3.0	0.8	185	28.6	8
1515	3.0	1.6	150	28.8	7
1615	3.0	2.4	170	29.6	4
1715	3.0	1.9	170	30.8	5
1814	3.0	1.6	170	31.6	3
1912	3.0	1.1	170	31.9	5
			1/4 Depth		
0641	13.2	1.7	180	31.6	5
0717	13.0	1.8	100	31.6	9
0816	13.0	1.4	10	31.3	6
0917	13.0	2.4	340	30.6	9
1015	12.0	2.6	340	30.1	10
1118	11.5	2.1	340	29.0	13
1214	11.2	1.3	345	28.6	9
1316	10.7	0.7	350	28.6	4
1414	11.0	1.0	180	28.6	9
1514	11.7	1.8	180	29.1	5
1614	12.2	2.3	170	29.7	5
1714	12.5	2.0	190	30.9	6
1813	13.0	1.7	175	31.6	11
1911	13.0	1.1	180	32.0	11
			Middepth		
0640	26.5	2.0	160	31.9	12
0715	26.0	2.0	130	32.1	21
0815	26.0	0.4	290	32.1	5
0916	26.0	1.9	350	31.5	13
1014	24.0	2.5	350	30.6	15
1115	23.0	1.8	340	29.2	14
1213	22.5	1.4	340	29.4	13
1315	21.5	1.0	340	29.3	6
1413	22.0	1.0	170	29.0	8

(Continued)

Table A13 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1513	23.5	2.3	170	29.7	8
1613	24.5	2.7	150	30.2	8
1713	25.0	2.5	190	31.2	11
1812	26.0	2.0	160	31.7	11
1910	26.0	1.3	170	32.1	14
			3/4 Depth		
0637	39.7	1.6	150	32.0	17
0714	39.0	2.0	150	32.1	14
0814	39.0	1.0	10	32.3	5
0915	39.0	1.2	340	32.0	15
1013	36.0	1.8	350	31.7	13
1114	34.5	2.0	340	30.7	19
1212	33.7	0.9	350	30.1	23
1314	32.2	0.5	310	30.6	17
1412	33.0	1.5	180	30.7	11
1512	35.3	1.9	165	31.4	51
1612	36.7	2.5	155	30.7	8
1712	37.5	2.2	155	31.3	29
1811	39.0	1.6	155	31.7	37
1909	39.0	1.3	165	32.2	22
			Bottom		
0635	51.0	1.8	160	31.9	27
0712	50.0	1.8	150	32.2	20
0812	50.0	0.6	270	32.4	10
0914	50.0	0.8	340	32.0	30
1012	46.0	1.0	300	31.8	17
1112	44.0	1.2	350	30.9	26
1211	43.0	0.4	290	30.7	51
1312	41.0	0.2	270	30.7	34
1410	42.0	0.7	200	31.0	72
1510	45.0	1.0	160	31.8	115
1611	47.0	2.1	160	30.7	19
1710	48.0	1.7	140	31.2	39
1810	50.0	1.2	150	31.7	41
1907	50.0	1.0	235	32.2	52

Table A14

Data Observed at Station 4D

7 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0651	3.0	1.6	160	31.7	5
0732	3.0	0.1	10	31.3	6
0827	3.0	2.0	340	29.9	7
0927	3.0	3.1	345	29.7	6
1025	3.0	2.9	345	29.9	5
1129	3.0	2.4	350	29.0	5
1226	3.0	1.4	340	28.7	2
1325	3.0	1.0	325	28.7	4
1422	3.0	1.0	175	28.7	5
1522	3.0	2.1	155	29.1	8
1622	3.0	2.3	170	29.7	5
1722	3.0	2.0	165	30.9	5
1821	3.0	2.1	160	31.8	6
1919	3.0	1.2	180	32.3	8
			1/4-Depth		
0650	12.5	1.8	170	31.7	5
0731	11.5	0.3	230	31.7	6
0826	12.0	1.9	330	30.7	5
0926	12.5	2.5	345	30.9	7
1024	12.0	2.4	340	30.1	9
1128	11.5	2.1	345	29.0	8
1225	12.0	1.5	330	28.7	7
1324	11.7	1.0	310	28.7	7
1421	12.0	1.1	180	28.6	6
1521	12.0	2.2	155	29.6	11
1621	12.5	2.5	150	30.0	9
1721	12.5	2.4	160	31.3	8
1820	13.0	2.0	170	31.8	9
1918	13.0	1.2	165	32.2	6
			Middepth		
0650	25.0	2.0	170	31.9	5
0730	23.0	0.1	90	31.9	6
0825	24.0	0.9	330	32.1	7
0925	25.0	2.1	340	31.3	8
1023	24.0	2.4	340	30.5	9
1127	23.0	2.2	350	29.4	9
1224	24.0	1.2	340	29.3	10
1322	23.5	0.4	150	29.5	8
1420	24.0	1.4	180	29.1	7

(Continued)

Table A14 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1520	24.0	2.5	160	30.2	11
1620	25.0	2.4	165	30.6	19
1720	25.0	2.0	150	31.3	8
1819	26.0	2.0	160	31.7	6
1917	26.9	1.3	165	32.2	18
			3/4 Depth		
0648	37.5	1.8	180	31.9	12
0729	34.5	0.4	140	32.2	10
0824	36.0	0.6	280	32.3	9
0924	37.5	1.2	340	31.7	17
1021	36.0	1.7	330	31.2	24
1126	34.5	1.1	355	30.8	21
1223	36.0	0.4	20	31.1	19
1321	35.2	0.6	200	31.1	15
1418	36.0	1.7	190	30.9	8
1518	36.0	2.2	175	31.2	23
1619	37.5	2.0	160	31.0	35
1718	37.5	2.2	160	31.3	16
1818	39.0	2.0	160	31.8	12
1916	39.0	1.3	160	32.3	24
			Bottom		
0646	48.0	1.4	170	32.0	29
0727	44.0	0.3	120	32.3	30
0822	46.0	0.8	270	32.3	13
0923	48.0	0.9	345	32.1	31
1020	46.0	1.0	320	31.6	24
1125	44.0	0.6	345	31.3	54
1220	46.0	0.4	355	31.1	45
1320	45.0	0.7	190	31.4	46
1417	46.0	1.4	190	31.5	58
1518	36.0	2.2	175	31.5	78
1617	48.0	1.4	150	31.0	56
1717	50.0	1.6	160	31.4	28
1817	50.0	1.7	160	31.8	19
1915	50.0	1.2	170	32.3	31

Table A15

Data Observed at Station 4A

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0602	3.0	1.3	180	30.4	22
0702	3.0	0.7	150	30.9	14
0802	3.0	0.6	0	30.9	11
0903	3.0	2.2	350	29.4	5
1002	3.0	1.7	350	29.7	5
1102	3.0	1.4	350	29.5	11
1202	3.0	1.1	340	29.0	17
1304	3.0	0.4	70	28.9	12
1402	3.0	0.6	160	28.9	9
1503	3.0	1.4	160	29.0	12
1603	3.0	1.3	170	29.5	14
1702	3.0	1.3	175	29.5	14
1802	3.0	1.5	190	30.1	16
1855	3.0	1.4	175	31.2	20
			Middepth		
0601	10.0	1.4	155	30.6	26
0701	8.0	0.7	185	31.0	23
0801	6.0	0.3	15	31.4	21
0902	10.0	1.3	350	31.3	10
1001	10.0	1.6	345	29.8	13
1101	8.5	1.3	340	29.5	13
1201	7.0	0.8	0	29.0	20
1303	4.0	0.7	330	28.9	21
1401	9.0	0.4	330	28.9	8
1502	10.0	1.4	180	29.1	14
1601	10.5	1.3	165	29.6	14
1701	10.5	1.4	170	29.6	23
1801	12.0	1.6	180	30.5	21
1854	12.5	1.2	170	31.3	63
			Bottom		
0600	18.0	1.0	155	30.6	38
0700	14.0	0.6	190	31.0	33
0800	10.0	0.3	25	31.4	35
0900	18.0	0.5	0	31.7	38
1000	18.0	1.0	290	29.9	33
1100	15.0	1.1	320	29.6	17
1200	12.0	0.8	330	29.0	26
1302	6.0	0.8	330	28.9	15
1400	16.0	0.6	290	28.9	9

(Continued)

Table A15 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1500	18.0	0.6	170	29.0	23
1600	19.0	1.1	160	29.5	14
1700	21.0	1.1	180	29.6	36
1800	22.0	1.0	120	30.6	35
1853	23.0	0.9	145	31.3	58

Table A16

Data Observed at Station 4B

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0607	3.0	1.2	180	30.0	11
0707	3.0	1.0	30	31.0	5
0808	3.0	0.8	325	31.2	8
0909	3.0	2.2	350	30.0	4
1008	3.0	3.2	345	29.7	5
1108	3.0	2.6	340	29.6	9
1208	3.0	2.2	340	29.0	6
1309	3.0	1.1	340	28.9	7
1407	3.0	0.7	160	28.9	19
1507	3.0	1.5	170	29.0	9
1608	3.0	2.0	160	29.5	7
1707	3.0	1.6	175	29.7	19
1807	3.0	1.8	190	30.4	35
1859	3.0	1.4	185	31.0	14
			Middepth		
0606	14.0	1.2	160	30.8	48
0706	14.0	1.0	195	31.3	10
0807	13.5	0.5	330	31.5	10
0908	13.5	1.6	350	31.2	4
1007	12.5	2.6	340	30.2	14
1107	12.0	2.4	340	29.6	15
1207	11.0	1.9	340	29.0	11
1308	11.0	1.0	330	28.9	7
1406	11.0	1.0	180	29.0	3
1506	11.5	1.5	180	29.0	15
1607	12.5	1.9	160	29.7	11
1706	13.5	1.6	160	29.7	15
1806	14.0	1.9	165	30.8	16
1858	14.5	1.6	175	31.5	21
			Bottom		
0605	26.0	0.8	130	30.8	130
0705	26.0	0.5	200	31.5	39
0806	25.0	0.4	5	31.8	28
0907	25.0	0.7	340	31.6	23
1006	23.0	1.8	330	30.2	36
1106	22.0	1.5	330	29.6	19
1206	20.0	1.4	335	29.1	11
1307	20.0	0.8	320	28.9	8
1405	20.0	1.0	160	29.3	16

(Continued)

Table A16 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1505	21.0	1.3	190	29.0	20
1606	23.0	1.2	165	29.7	14
1705	25.0	1.5	160	29.7	43
1805	26.0	1.5	160	30.8	20
1857	27.0	1.1	140	31.5	33

Table A17

Data Observed at Station 4C

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0614	3.0	1.5	165	30.8	12
0715	3.0	1.0	190	31.6	7
0816	3.0	0.7	340	31.3	8
0916	3.0	2.4	350	29.9	9
1015	3.0	3.0	350	29.7	5
1116	3.0	2.5	350	29.6	9
1217	3.0	1.9	350	29.0	11
1317	3.0	1.0	330	28.9	8
1412	3.0	0.9	170	28.9	7
1514	3.0	1.8	175	29.0	8
1614	3.0	2.3	160	29.6	6
1714	3.0	2.2	160	30.0	39
1813	3.0	1.8	180	31.0	26
1906	3.0	1.5	150	31.6	28
			1/4 Depth		
0613	12.0	1.6	170	30.9	16
0713	13.0	1.0	200	31.4	6
0815	9.0	0.4	335	31.4	8
0915	10.5	2.0	350	30.3	9
1014	10.5	2.6	340	30.1	10
1115	10.0	2.6	340	29.6	5
1216	9.5	1.8	335	29.1	32
1316	9.0	0.9	320	29.0	12
	Data were not recorded at 1400 due to submarine passage				
1513	11.0	1.6	180	29.0	8
1613	10.2	2.2	160	29.5	4
1713	11.0	2.0	160	30.0	13
1812	12.0	2.1	180	31.1	3
1905	12.0	1.3	145	31.6	34
			Middepth		
0612	24.0	1.9	170	31.0	22
0712	26.0	1.5	175	31.7	15
0814	18.0	0.3	320	31.6	8
0914	21.0	1.4	350	31.4	3
1013	21.0	2.0	345	30.7	24
1114	20.0	2.2	340	29.7	6
1215	19.0	1.4	340	29.2	15
1315	18.0	0.9	325	29.3	12

(Continued)

Table A17 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1411	14.0	0.9	160	29.1	9
1512	22.0	1.6	160	29.2	8
1612	20.5	2.3	160	29.9	8
1712	22.0	1.9	160	30.1	22
1811	24.0	2.2	160	31.2	14
1904	24.0	1.4	170	31.6	27
			3/4 Depth		
0611	36.0	1.8	160	31.2	58
0711	39.0	1.2	180	31.7	32
0813	27.0	0.2	270	31.9	15
0913	31.5	1.2	355	31.5	5
1012	31.5	1.8	340	31.4	13
1113	30.0	1.6	330	—*	16
1213	28.5	1.5	330	29.9	21
1314	27.0	0.7	330	29.6	13
	Data were not recorded at 1400 due to submarine passage				
1511	33.0	1.2	190	29.8	31
1611	30.7	2.3	170	30.2	21
1711	33.0	1.9	170	30.4	42
1810	36.0	2.0	150	31.3	18
1903	36.0	1.2	205	31.5	11
			Bottom		
0610	46.0	1.1	175	31.2	96
0710	50.0	0.8	240	31.7	33
0812	34.0	0.1	230	31.9	21
0912	40.0	0.8	340	31.6	17
1011	40.0	1.2	335	31.4	20
1112	38.0	1.0	290	31.2	32
1212	36.0	1.0	300	30.0	26
1313	34.0	0.4	315	29.8	16
1410	26.0	0.2	270	29.6	19
1510	42.0	0.8	170	30.4	87
1610	39.0	1.8	180	30.1	33
1710	42.0	1.2	200	30.5	46
1809	46.0	1.2	195	31.2	22
1902	46.0	0.8	165	31.6	166

* No analysis recorded.

Table A18

Data Observed at Station 4D

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0621	3.0	1.7	160	31.0	4
0726	3.0	1.2	160	31.6	7
0823	3.0	0.7	320	31.2	8
0924	3.0	2.2	345	30.1	3
1023	3.0	2.7	345	29.8	8
1123	3.0	2.6	345	29.6	8
1226	3.0	2.0	330	29.0	7
1324	3.0	1.1	335	29.0	10
1419	3.0	0.6	150	29.1	6
1520	3.0	1.5	165	29.1	8
1621	3.0	2.5	160	29.6	4
1721	3.0	2.2	150	30.3	7
1819	3.0	2.2	180	31.1	8
1913	3.0	1.8	130	31.7	6
			1/4 Depth		
0620	13.0	2.0	160	31.2	20
0725	13.0	1.2	170	31.6	9
0822	13.0	0.3	330	31.6	8
0923	13.0	2.0	350	30.5	3
1022	13.0	2.8	340	30.1	10
1122	12.5	2.6	340	29.6	11
1225	12.0	2.0	340	29.1	11
1323	12.0	1.0	330	29.2	10
1418	11.7	1.0	160	29.1	8
1519	12.0	1.8	160	29.3	8
1620	12.5	2.4	165	29.7	5
1720	13.0	2.2	155	30.3	12
1818	13.2	2.1	170	31.2	8
1912	13.2	2.0	165	31.8	8
			Middepth		
0619	26.0	2.1	155	31.2	6
0724	26.0	1.2	165	31.7	11
0821	26.0	0.3	240	31.9	10
0922	26.0	1.6	340	31.2	10
1021	26.0	2.4	345	30.6	7
1121	25.0	2.4	345	29.9	16
1224	24.0	1.5	340	29.4	18
1322	24.0	0.8	340	29.4	7
1417	23.5	0.5	160	29.3	10

(Continued)

Table A18 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1518	24.0	1.4	160	29.6	9
1619	25.0	2.3	160	29.9	15
1719	26.0	2.2	155	30.4	12
1817	26.5	2.6	155	31.3	21
1911	26.5	1.9	160	31.7	6
			3/4 Depth		
0618	39.0	2.0	160	31.3	8
0723	39.0	1.0	160	31.7	21
0820	39.0	0.6	245	32.0	18
0921	39.0	1.2	340	31.6	9
1020	39.0	1.8	335	31.0	9
1120	37.5	1.6	330	30.6	31
1222	36.0	1.0	330	30.2	37
1321	36.0	0.4	300	30.0	26
1416	35.2	0.9	150	30.0	14
1517	36.0	1.7	160	30.7	38
1618	37.5	1.8	165	30.5	36
1718	39.0	2.4	160	30.5	40
1816	39.7	2.2	150	31.4	22
1910	39.7	2.0	145	31.7	19
			Bottom		
0617	50.0	1.5	165	31.4	26
0722	50.0	0.8	150	31.8	15
0819	50.0	0.8	230	32.0	16
0920	50.0	0.9	310	31.8	8
1019	50.0	1.0	320	31.1	23
1119	48.0	0.7	310	30.7	48
1221	46.0	0.4	315	30.4	82
1320	46.0	0.6	270	30.2	30
1415	45.0	0.9	150	30.1	63
1516	46.0	1.2	160	30.8	68
1617	48.0	1.0	160	30.6	12
1717	50.0	1.5	170	30.5	47
1815	51.0	1.8	150	31.3	26
1908	51.0	1.8	130	31.8	11

Table A19

Data Observed at Station 5A

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0611	3.0	0.2	74	28.8	10
0705	3.0	0.6	336	29.1	7
0804	3.0	0.5	348	29.1	3
0904	3.0	1.1	320	29.4	4
1010	3.0	1.0	312	29.4	6
1106	3.0	0.7	324	29.3	6
1206	3.0	0.7	328	29.4	4
1310	3.0	0.6	182	29.4	4
1405	3.0	0.5	110	29.2	5
1506	3.0	0.9	126	28.8	5
1604	3.0	0.6	142	28.7	8
1704	3.0	0.6	122	29.0	6
1806	3.0	0.3	280	—*	8
1900	3.0	0.6	34	29.2	5
			1/4 Depth		
0610	11.6	0.3	124	29.6	10
0704	11.0	0.6	330	29.5	9
0803	10.6	0.7	344	29.6	5
0903	11.6	1.0	316	29.8	5
1009	11.9	0.6	318	29.8	4
1105	10.6	0.6	334	29.5	8
1205	10.7	0.6	319	29.5	3
1309	10.3	0.1	240	29.6	5
1404	10.7	0.1	180	29.4	5
1505	11.0	0.3	130	29.2	5
1603	11.4	0.2	174	29.2	6
1703	11.8	0.2	88	29.3	7
1805	12.4	0.4	142	29.6	12
1859	12.5	0.3	106	29.7	8
			Middepth		
0609	23.2	0.5	126	29.8	10
0703	21.9	0.2	10	29.8	8
0802	21.2	0.4	346	29.9	9
0902	23.2	0.4	336	30.2	10
1008	23.9	0.5	312	30.2	9
1104	21.1	0.4	336	29.9	5
1204	21.5	0.5	325	29.7	4

(Continued)

* No salinity analysis recorded.

Table A19 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1308	20.7	0.2	294	29.6	6
1403	21.5	0.2	354	29.6	7
1504	22.0	0.1	156	29.6	16
1602	22.7	0.3	122	29.3	6
1702	23.5	0.3	102	29.3	4
1804	24.9	0.2	156	29.6	13
1858	25.1	0.3	42	30.0	13
			3/4 Depth		
0608	34.8	0.7	122	30.3	27
0702	32.9	0.4	88	30.1	37
0801	31.8	0.3	42	30.1	19
0901	34.8	0.1	30	30.5	14
1006	35.8	0.2	278	30.7	21
1103	31.7	0.3	344	30.5	10
1203	32.2	0.1	302	30.2	11
1307	31.0	0.3	316	29.7	7
1402	32.2	0.2	300	29.7	7
1503	33.0	0.0	102	29.7	26
1601	34.1	0.2	100	29.7	9
1701	35.3	0.3	102	29.2	8
1803	37.3	0.3	130	29.6	25
1857	37.6	0.4	336	30.1	29
			Bottom		
0606	44.5	0.0	130	30.3	92
0701	41.8	0.1	142	30.1	140
0800	40.4	0.2	284	30.5	79
0900	44.3	0.1	22	30.8	25
1004	45.8	0.0	276	30.8	17
1102	40.2	0.0	24	30.6	55
1201	41.0	0.0	240	30.3	57
1305	41.4	0.2	343	30.3	24
1401	41.0	0.2	228	30.3	283
1502	42.0	0.1	40	30.0	32
1600	43.5	0.2	90	30.3	39
1700	45.0	0.2	88	29.2	10
1800	47.8	0.0	112	29.3	203
1856	48.2	0.[illegible]	58	30.1	139

Table A20

Data Observed at Station 5B

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0620	3.0	0.2	78	28.9	4
0714	3.0	0.2	130	29.3	10
0811	3.0	0.4	308	29.1	5
0912	3.0	1.1	314	29.1	6
1018	3.0	1.0	306	29.2	4
1113	3.0	1.0	314	28.3	5
1213	3.0	0.6	324	29.4	5
1359	3.0	0.1	120	29.4	6
1413	3.0	0.6	134	29.1	3
1512	3.0	0.8	110	28.5	7
1610	3.0	0.6	122	28.9	4
1711	3.0	0.4	96	29.1	3
1814	3.0	0.5	82	—*	6
1909	3.0	0.3	56	29.3	4
			1/4-Depth		
0619	12.5	0.1	94	29.1	4
0713	12.2	0.2	68	29.6	11
0810	13.0	0.4	314	29.5	6
0911	13.2	0.6	320	29.8	6
1017	12.8	0.6	330	29.8	6
1112	12.6	0.7	309	29.5	8
1212	10.7	0.6	319	29.5	4
1358	11.2	0.1	275	29.5	4
1412	11.6	0.3	208	29.4	2
1511	11.7	0.4	116	29.0	4
1609	12.3	0.4	82	29.0	3
1710	12.7	0.6	70	29.2	6
1813	13.1	0.2	114	—*	11
1908	13.3	0.2	66	29.5	5
			Middepth		
0618	25.2	0.4	94	29.8	12
0712	25.4	0.3	82	30.0	17
0809	26.0	0.3	190	30.2	13
0910	26.4	0.3	352	30.3	8
1016	25.6	0.4	326	30.3	11
1111	25.1	0.4	300	30.2	11
1211	24.0	0.3	316	29.7	6

(Continued)

No salinity analysis recorded.

Table A20 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1357	22.4	0.1	329	29.6	5
1411	23.1	0.1	228	29.7	5
1510	23.4	0.1	140	29.5	3
1608	24.6	0.3	84	29.5	5
1709	25.4	0.7	90	29.5	11
1812	26.2	0.5	106	—*	19
1907	26.6	0.3	88	29.9	11
			3/4 Depth		
0617	37.7	0.7	100	30.0	23
0711	37.5	1.0	92	30.1	24
0808	39.1	0.3	80	30.6	16
0909	39.6	0.1	42	30.5	8
1015	38.4	0.2	15	30.7	11
1110	37.7	0.2	324	30.4	13
1210	36.0	0.1	325	30.3	11
1356	33.6	0.1	338	29.8	6
1410	34.7	0.1	200	29.9	6
1509	35.1	0.1	210	29.7	5
1607	36.9	0.2	2	29.8	7
1708	38.1	0.3	118	29.5	14
1811	39.3	0.6	80	—*	24
1906	39.9	0.6	78	30.1	23
			Bottom		
0616	48.3	0.5	102	30.0	76
0710	48.7	0.8	62	30.2	43
0807	50.1	0.1	100	30.6	86
0908	50.7	0.1	22	30.9	25
1014	49.2	0.1	90	30.9	21
1109	48.2	0.1	324	30.9	62
1209	46.0	0.1	301	30.8	40
1254	42.8	0.1	356	30.7	41
1409	44.2	0.2	210	30.7	43
1508	44.8	0.1	222	30.2	73
1606	47.3	0.2	300	30.3	26
1707	48.9	0.1	18	29.5	24
1810	50.5	0.2	44	—*	61
1905	51.1	0.4	56	30.1	45

No salinity analysis recorded.

Table A21

Data Observed at Station 5C

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0630	3.0	0.6	88	28.9	4
0722	3.0	0.2	66	29.2	6
0820	3.0	0.7	320	29.1	6
0921	3.0	0.7	316	29.0	8
1027	3.0	0.6	308	29.2	3
1120	3.0	0.5	325	29.2	5
1219	3.0	0.3	354	29.3	4
1317	3.0	0.3	18	29.3	9
1419	3.0	0.4	110	29.1	1
1519	3.0	0.7	120	28.8	6
1618	3.0	0.7	120	29.0	6
1717	3.0	1.2	96	28.9	4
1820	3.0	1.4	94	29.3	5
1918	3.0	0.4	106	29.5	4
			1/4 Depth		
0629	13.1	0.7	110	29.2	8
0721	13.4	0.2	116	29.3	8
0819	13.5	0.6	326	29.9	9
0920	13.3	0.7	330	29.7	8
1026	13.1	0.5	332	29.8	6
1119	12.8	0.5	326	29.4	6
1218	12.4	0.6	310	29.4	5
1316	12.2	0.2	310	29.6	6
1418	12.1	0.1	162	29.5	3
1518	12.4	0.5	148	29.0	5
1617	12.2	0.6	104	29.3	5
1716	12.5	0.9	100	29.2	5
1819	12.7	0.9	94	29.6	8
1917	12.3	0.6	86	29.6	4
			Middepth		
0628	26.2	1.0	106	29.7	13
0720	26.8	0.9	112	29.7	14
818	27.1	0.2	260	30.1	8
0919	26.6	0.4	332	30.2	10
1025	26.2	0.4	320	30.3	12
1118	25.7	0.4	313	30.1	7
1217	24.9	0.5	303	29.8	7
1315	24.4	0.1	48	29.8	8
1417	24.2	0.1	222	29.6	3

(Continued)

Table A21 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Middepth (Continued)		
1517	24.7	0.2	210	29.4	6
1616	24.3	0.3	88	29.7	9
1715	25.0	0.5	102	29.5	10
1818	25.3	0.7	78	29.7	19
1916	24.6	0.4	108	29.9	7
			3/4 Depth		
0627	39.3	0.7	130	29.9	25
0719	40.2	1.3	110	30.1	21
0817	40.6	0.3	114	30.5	10
0918	39.9	0.3	18	30.8	17
1024	39.3	0.2	344	30.6	9
1117	38.5	0.2	294	30.4	11
1216	37.3	0.3	311	30.4	11
1314	36.6	0.2	30	30.0	8
1416	36.3	0.1	190	29.9	6
1516	37.1	0.1	254	29.7	11
1615	36.5	0.3	118	29.8	7
1714	37.5	0.2	100	29.7	13
1817	38.0	0.3	78	—*	30
1915	36.9	0.6	94	30.1	23
			Bottom		
0626	50.4	0.6	104	30.0	47
0718	51.5	0.8	104	30.1	29
0816	52.2	0.1	132	30.7	6
0917	51.3	0.2	12	30.9	22
1022	50.4	0.1	318	30.9	18
1116	49.4	0.1	304	30.9	13
1215	47.8	0.1	310	30.9	14
1313	46.8	0.1	325	30.8	33
1415	46.3	0.2	206	30.8	19
1515	46.5	0.0	132	30.5	26
1614	46.6	0.1	102	30.0	27
1713	48.0	0.1	88	29.6	14
1816	48.6	0.3	42	—*	124
1914	47.2	0.3	64	30.1	29

* No salinity analysis recorded.

Table A22

Data Observed at Station 7A

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0636	3.0	2.3	138	28.8	12
0707	3.0	1.9	138	28.8	14
0802	3.0	1.2	126	29.0	9
0902	3.0	0.4	342	28.8	4
1002	3.0	2.4	326	28.7	7
1102	3.0	2.6	330	28.4	13
1202	3.0	2.3	327	28.4	21
1302	3.0	1.8	330	28.1	31
1402	3.0	0.7	312	27.7	36
1502	3.0	1.5	86	27.7	23
1603	3.0	2.5	142	28.1	18
1702	3.0	2.5	138	28.4	18
1804	3.0	2.5	140	28.8	12
1852	3.0	2.5	140	29.1	9
			Middepth		
0635	17.0	2.0	138	28.8	14
0706	17.0	2.0	138	28.7	14
0801	17.0	1.3	122	29.0	7
0901	17.5	0.5	322	28.9	4
1002	16.8	2.0	314	28.9	11
1101	15.7	2.5	318	28.6	18
1201	15.1	2.2	315	28.5	20
1301	14.8	1.6	310	28.2	23
1401	14.5	0.6	310	27.8	29
1501	14.7	0.9	164	27.7	14
1602	14.9	2.4	142	28.1	35
1701	15.5	2.1	136	28.5	29
1803	16.5	2.5	140	28.8	9
1851	16.7	2.2	146	29.1	12
			Bottom		
0634	32.0	1.3	142	29.4	19
0705	32.0	1.2	130	28.8	17
0800	32.0	0.9	126	29.0	9
0900	33.0	0.2	306	28.9	4
1000	31.5	1.4	306	28.1	10
1100	29.3	1.7	304	28.6	8
1200	28.1	1.5	310	28.5	19
1300	27.5	1.4	260	28.1	31
1400	27.0	0.4	310	27.8	30

(Continued)

Table A22 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1500	27.4	0.5	112	27.8	20
1601	27.7	1.7	128	28.1	39
1700	29.0	1.9	142	28.2	22
1801	31.0	1.8	144	28.0	21
1850	31.4	1.6	128	29.0	13

Table A23

Data Observed at Station 7B

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0643	3.0	1.6	146	28.6	15
0713	3.0	1.5	142	28.7	19
0808	3.0	0.7	150	28.8	11
0909	3.0	1.1	326	28.9	7
1009	3.0	2.8	324	28.5	21
1108	3.0	3.1	326	28.2	21
1209	3.0	3.0	329	28.1	27
1309	3.0	2.3	326	27.9	33
1409	3.0	0.9	290	27.6	27
1509	3.0	1.3	154	27.8	17
1610	3.0	1.6	150	28.1	18
1708	3.0	2.2	148	28.4	23
1809	3.0	2.2	150	28.8	16
1857	3.0	2.2	138	29.0	13
			Middepth		
0642	10.5	1.5	148	28.7	18
0712	10.0	1.4	144	28.7	19
0807	10.5	0.7	164	28.9	11
0908	10.0	1.0	300	29.1	8
1008	9.3	2.2	324	28.6	26
1107	8.8	2.9	324	28.3	24
1208	7.6	2.4	324	28.1	32
1308	7.1	2.0	324	27.8	31
1408	7.3	0.9	300	27.6	30
1508	8.1	1.3	170	27.9	33
1609	8.5	1.6	136	28.1	18
1707	9.7	2.0	146	28.4	19
1808	10.1	2.1	150	28.7	18
1856	10.6	1.8	150	29.0	16
			Bottom		
0641	19.0	0.9	150	28.6	20
0711	18.0	1.2	148	28.7	15
0806	19.0	0.7	172	28.9	11
0907	18.0	0.8	310	29.0	9
1007	16.5	1.6	316	28.5	18
1106	15.5	2.2	331	28.3	26
1207	13.1	2.0	322	28.1	29
1307	12.2	1.9	340	27.9	32
1407	12.6	1.0	304	27.7	31

(Continued)

Table A23 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1507	14.2	0.9	166	27.9	39
1608	15.0	1.5	150	28.1	22
1706	17.3	1.6	150	28.4	25
1807	18.1	1.7	128	28.7	13
1855	19.1	1.3	150	29.1	8

Table A24

Data Observed at Station 7C

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0652	3.0	2.0	98	28.1	20
0720	3.0	1.7	99	28.1	22
0816	3.0	1.2	91	28.2	12
0918	3.0	0.0	338	28.2	6
1019	3.0	1.9	282	28.5	15
1117	3.0	2.2	282	28.1	19
1221	3.0	1.9	280	28.0	39
1318	3.0	1.7	282	27.8	32
1419	3.0	0.6	274	27.5	23
1517	3.0	0.4	36	27.6	21
1617	3.0	1.5	108	27.6	20
1715	3.0	2.2	106	28.0	40
1816	3.0	2.1	110	28.3	39
1904	3.0	1.1	100	28.3	27
			Middepth		
0651	7.5	1.8	104	28.1	24
0719	7.5	1.4	97	28.1	23
0815	7.3	1.1	96	28.2	9
0917	8.0	0.1	8	28.3	7
1018	6.6	2.0	280	28.5	18
1116	6.3	2.2	272	28.1	25
1220	5.3	2.0	280	28.1	42
1317	5.6	1.5	276	27.8	34
1418	4.4	0.7	271	27.5	20
1516	4.6	0.5	332	27.5	16
1616	6.3	1.4	106	27.6	21
1714	7.1	2.0	102	28.0	40
1815	8.1	2.3	101	28.3	58
1903	8.2	1.9	104	28.3	29
			Bottom		
0650	13.0	1.4	110	28.3	23
0718	13.0	1.2	98	28.2	24
0814	12.5	1.2	68	28.2	13
0916	14.0	0.1	60	28.2	7
1017	11.2	1.5	276	28.5	22
1115	10.6	1.5	258	28.1	30
1219	8.6	2.0	270	28.1	40
1316	9.2	1.4	230	27.8	41
1417	6.7	0.7	310	27.7	22

(Continued)

Table A24 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1515	7.1	0.4	330	27.7	17
1615	10.6	1.0	92	28.2	11
1713	12.2	1.8	100	28.2	37
1814	14.2	1.7	106	28.3	68
1902	14.3	1.8	86	29.0	16

Table A25

Data Observed at Station 7D

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0658	3.0	1.5	93	28.0	18
0727	3.0	1.4	97	28.1	17
0822	3.0	0.7	99	28.0	15
0924	3.0	1.1	308	28.1	8
1024	3.0	2.2	281	28.5	23
1123	3.0	2.3	284	28.0	25
1227	3.0	1.6	270	28.0	48
1323	3.0	1.2	269	27.8	51
1424	3.0	0.9	272	27.6	33
1522	3.0	0.2	348	27.5	12
1623	3.0	1.1	100	27.6	30
1721	3.0	1.8	100	28.0	20
1821	3.0	1.8	96	28.3	27
1909	3.0	1.6	99	28.1	23
			Middepth		
0657	6.5	1.5	94	28.0	18
0726	6.3	1.3	98	28.1	20
0821	6.4	0.7	86	28.0	16
0923	5.8	1.0	290	28.1	9
1023	5.3	2.2	278	28.6	23
1122	4.6	2.2	282	28.0	30
	Data were not recorded 1200-1500 due to shallow water				
1622	4.8	0.9	92	27.6	28
1720	5.8	1.5	96	28.0	24
1820	6.3	1.6	92	28.2	25
1908	6.6	1.6	90	28.2	27
			Bottom		
0656	11.0	1.2	94	28.0	19
0725	10.5	1.0	108	28.1	19
0820	11.8	0.7	66	28.1	16
0922	9.5	0.4	228	28.2	9
1022	8.6	2.1	266	28.5	27
1121	7.2	1.8	276	28.0	29
1226	5.0	1.0	264	28.0	56
1322	4.8	0.6	282	27.8	63
1423	4.9	0.8	262	27.6	32
1521	6.0	0.3	6	27.6	21

(Continued)

Table A25 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1621	7.6	1.2	72	27.6	25
1719	9.5	1.4	106	28.0	23
1819	10.6	1.4	86	28.3	41
1907	11.1	1.3	78	28.3	25

Table A26

Data Observed at Station 8A

8 May 1990

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
0614	3.0	1.5	350	28.2	22
0704	3.0	1.5	346	28.1	20
0806	3.0	1.3	350	28.4	15
0905	3.0	0.4	30	28.4	9
1005	3.0	1.1	170	28.5	17
1104	3.0	1.1	168	28.2	15
1205	3.0	1.0	144	28.2	44
1302	3.0	0.4	30	28.2	26
1404	3.0	0.7	194	28.4	19
1504	3.0	0.6	210	28.3	12
1604	3.0	0.6	330	28.1	7
1704	3.0	1.2	340	28.3	28
1803	3.0	1.8	342	28.2	16
1852	3.0	1.8	350	28.4	21
			Middepth		
0612	5.7	1.6	348	28.2	24
0702	6.3	1.5	350	28.2	26
0804	6.3	1.3	342	28.4	21
0902	6.1	0.3	298	28.5	11
1003	5.8	1.1	160	28.5	18
1102	4.8	1.1	175	28.2	17
1203	4.2	1.0	184	28.2	55
	Data were not recorded 1300-1500 due to shallow water				
1602	4.6	0.6	330	28.1	10
1702	5.0	1.1	340	28.3	34
1801	6.0	1.8	342	28.2	29
1850	6.1	1.7	342	28.4	28
			Bottom		
0610	9.5	1.5	342	28.2	32
0700	10.5	1.3	345	28.1	36
0802	10.5	0.9	340	28.4	26
0900	10.2	0.1	50	28.5	17
1000	9.6	0.8	155	28.5	21
1100	7.5	1.1	170	28.3	23
1200	6.4	0.6	138	28.2	94
1300	4.2	0.4	154	28.2	29
1400	4.2	0.7	66	28.3	19
1500	5.5	0.4	230	28.2	12

(Continued)

Table A26 (Concluded)

Hour EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1600	7.2	0.4	332	28.2	14
1700	8.1	1.2	325	28.3	37
1800	10.0	1.6	340	28.2	45
1848	10.3	1.3	350	28.3	26

Table A27

Data Observed at Station 8B

8 May 1990

Time EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
620	3.0	1.7	340	28.2	21
712	3.0	1.8	345	28.2	25
811	3.0	1.3	350	28.4	18
913	3.0	0.6	322	28.5	9
1012	3.0	1.6	156	28.4	9
1110	3.0	1.4	160	28.2	23
1211	3.0	1.4	150	28.2	30
1310	3.0	1.3	152	28.3	35
1411	3.0	0.7	110	28.2	23
1508	3.0	0.6	50	28.1	12
1609	3.0	1.0	335	28.1	5
1709	3.0	1.7	330	28.3	24
1809	3.0	2.0	332	28.2	33
1858	3.0	1.9	342	28.4	29
			Middepth		
618	9.9	1.5	345	28.2	37
710	10.3	1.7	345	28.3	19
809	10.3	1.3	348	28.4	31
911	10.3	0.6	335	28.5	20
1010	11.0	1.3	180	28.5	17
1108	10.1	1.4	170	28.2	42
1209	9.3	1.3	156	28.3	98
1308	8.2	1.0	150	28.3	41
1410	6.3	0.6	60	28.4	24
1506	7.2	0.3	240	28.1	19
1607	7.6	1.2	345	28.2	10
1707	9.3	1.5	332	28.3	29
1807	10.0	1.8	338	28.2	44
1856	10.3	1.7	340	28.3	35
			Bottom		
616	17.8	0.9	310	28.3	57
708	18.5	0.9	328	28.3	43
807	18.7	0.6	30	28.4	57
909	18.5	0.4	315	28.5	13
1008	20.0	0.7	162	28.5	23
1106	18.3	1.2	160	28.3	60
1207	16.7	0.8	178	28.2	97

(Continued)

* Slack condition.

Table A27 (Concluded)

Time EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1306	14.4	0.6	195	28.4	55
1408	10.5	0.5	188	28.3	26
1505	12.4	—*	—*	28.2	18
1606	13.2	0.7	332	28.1	16
1706	16.5	1.2	330	28.3	41
1805	18.0	1.3	332	28.2	61
1854	18.7	1.3	340	28.3	71

Table A28

Data Observed at Station 8C

8 May 1990

Time EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Surface		
627	3.0	1.8	340	28.2	17
720	3.0	1.6	342	28.2	10
818	3.0	1.4	340	28.3	12
921	3.0	0.1	180	28.4	11
1018	3.0	1.7	158	28.4	6
1117	3.0	2.0	162	28.2	35
1217	3.0	2.4	150	28.5	14
1316	3.0	1.9	158	28.2	31
1416	3.0	1.2	140	28.1	20
1513	3.0	0.4	220	28.1	14
1615	3.0	0.8	310	28.1	9
1715	3.0	1.7	335	28.3	18
1814	3.0	1.9	338	28.2	20
1904	3.0	1.5	340	28 4	14
			Middepth		
625	10.6	1.6	340	28.1	20
718	11.0	1.5	342	28.3	14
816	11.0	1.3	348	28.4	18
919	9.7	0.8	335	28.5	14
1016	10.0	1.5	170	28.5	13
1115	8.9	2.3	150	28.2	34
1215	8.2	2.2	160	28.4	18
1314	7.9	1.7	160	28.2	38
1414	8.0	0.9	184	28.1	29
1512	7.9	0.5	118	28.1	15
1613	8.8	0.8	300	28.1	15
1713	9.8	1.6	332	28.3	24
1812	11.0	1.6	332	28.2	33
1902	11.0	1.3	340	28.3	38
			Bottom		
623	19.1	1.1	338	28.2	30
716	19.9	1.2	345	28.3	21
814	20.1	1.1	350	28.3	31
917	17.3	0.8	318	28.5	18
1014	18.0	0.9	160	28.6	44
1113	15.9	1.4	155	28.2	43
1213	14.5	1.4	152	28.4	22
1312	13.8	1.2	155	28.2	44
1412	14.1	0.4	220	28.1	39

(Continued)

Table A28 (Concluded)

Time EST	Depth ft	Speed fps	Direction deg	Salinity ppt	Suspended Sediment mg/l
			Bottom (Continued)		
1510	13.8	0.5	222	28.1	23
1611	15.5	0.4	315	28.2	30
1711	17.6	1.2	335	28.3	36
1811	20.0	1.3	325	28.3	54
1900	20.0	0.9	332	28.5	24

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